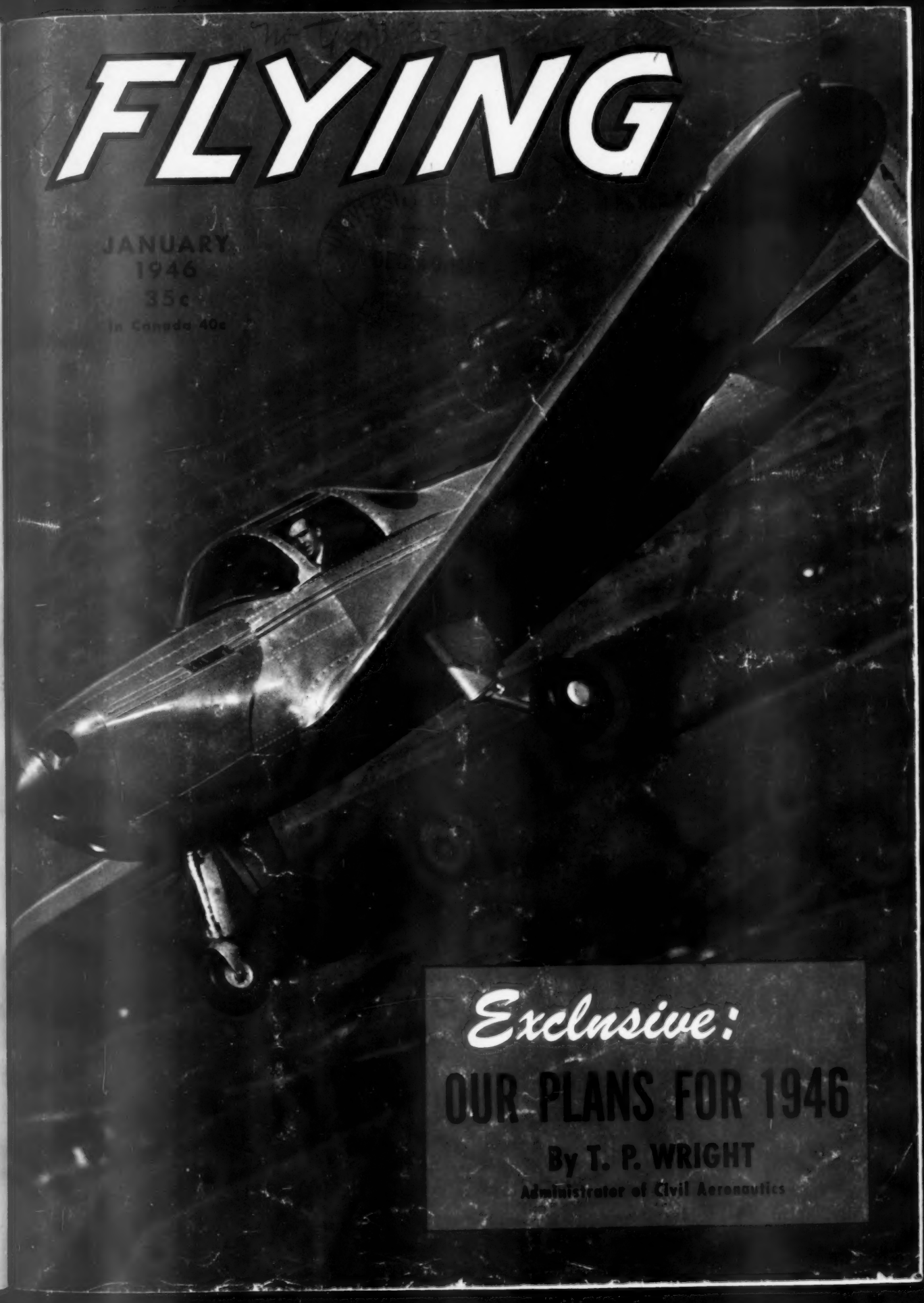
FLYING

JANUARY
1946
35c
In Canada 40c

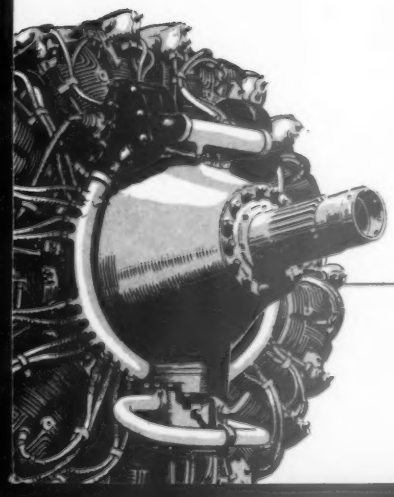


Exclusive:

OUR PLANS FOR 1946

By T. P. WRIGHT

Administrator of Civil Aeronautics



Cyclone 18 power, proved by ten million hours of operation for war, is now the first choice for flight on peacetime international trade routes. Seven airlines, operating in commercial competition between every major nation of all continents, have chosen to fly the Wright Cyclone-powered Lockheed Constellations.

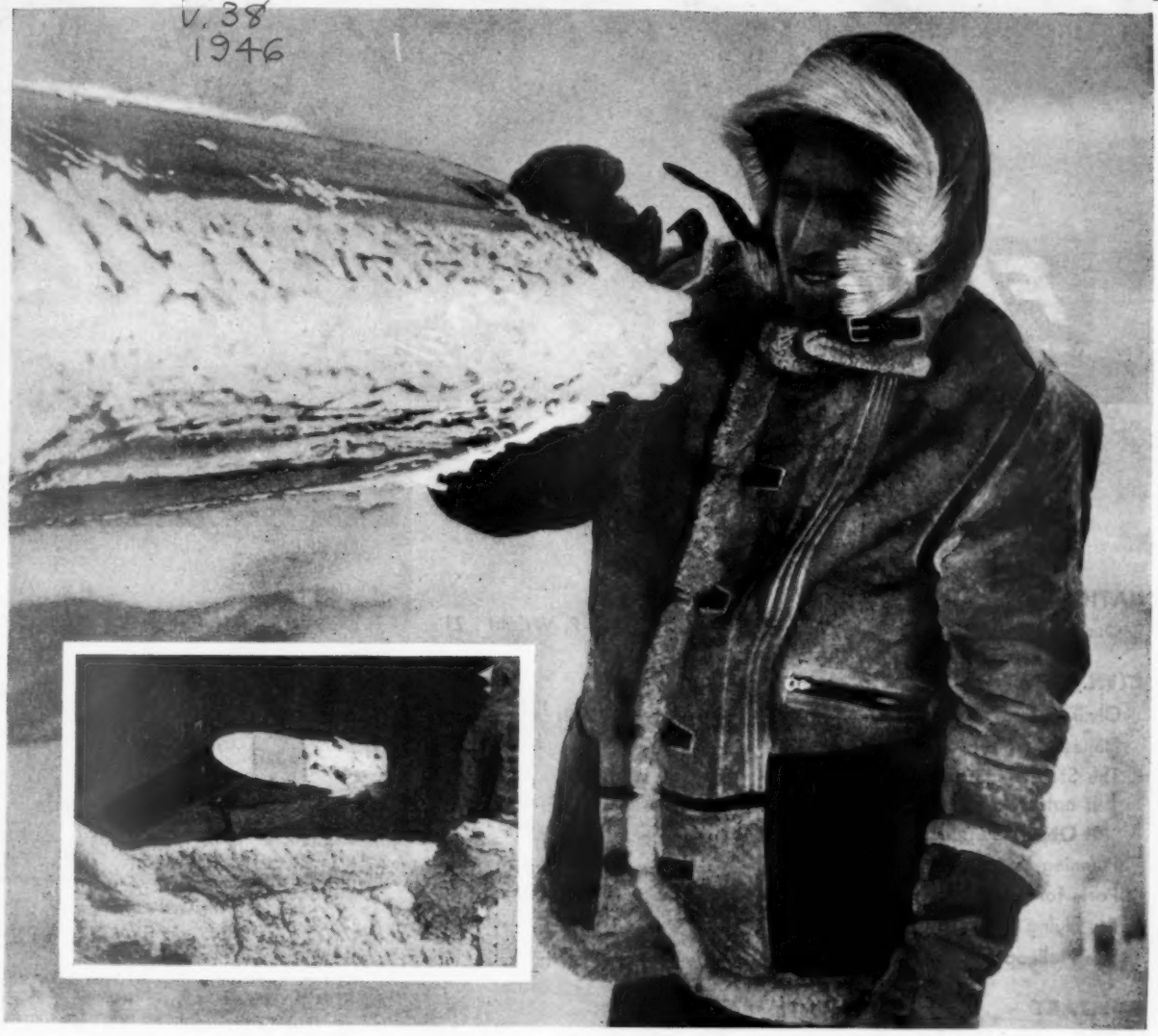
Cyclone 18 power enables the Constellation to reduce transoceanic fares and yet cut costs, to increase speed and still carry greater payloads. This performance, linked with Cyclone reliability, made it aviation's first choice as war's end brings commercial engines back into production again.

WRIGHT *Aircraft Engines*

AIR POWER FOR A WORLD AT PEACE

Wright Aeronautical Corporation, Paterson, N. J. • A Division of Curtiss-Wright

G29.1305
F677
V.38
1946



"Flying" in ice . . . without leaving the ground

Testing on a mountain top helps B. F. Goodrich build better De-Icers

DE-ICERS have been tested on planes flying through icing conditions and on test wings in the B. F. Goodrich wind tunnel—for years the only refrigerated one in the country. The results of these tests have been continuous De-Icer improvement.

But B. F. Goodrich scientists felt a need for a natural observatory for additional experiments. They wanted the answers to many questions on the properties of ice, and other data which could be more easily observed outdoors.

So they looked for a "natural" laboratory . . . and found it on top of 6,288-ft. Mt. Washington. Winds up to 231 m.p.h.! Icing conditions most of the winter. Besides that, a U. S. Weather Bureau, staffed with expert observers, was right at hand with exact information as to temperature, wind velocity, icing rate, density and type.

B. F. Goodrich mounted a wing section (like a weather vane so it always faced the wind) and installed test De-Icers. Almost constant heavy icing conditions gave physicists a chance to accumulate accurate data.

This is another example of the research that goes on . . . the constant fight B. F. Goodrich wages against airplane icing. It's another reason why B. F. Goodrich De-Icers are the best ice-protection devices ever developed for aircraft. The B. F. Goodrich Co., Aeronautical Division, Akron, Ohio.

Skyway or Highway

B.F.Goodrich

FIRST IN RUBBER

544378

lic in great quantity until they have convenience and utility more nearly approximating that of automobiles.

One phase of our program for 1946 will deal concretely with this need for better aircraft. In our budget request we have an item of $1,000,000 earmarked for use in encouraging the development of personal aircraft. If this appropriation is made, John Geisse, our private flying expert, will attempt to bring about improvements to personal planes through competitions with cash awards or through the medium of specific development contracts. Part of the funds may be used in stimulating the development of roadable airplanes with folding or readily removable wings.

Let me emphasize that on all these projects it will be the manufacturers, not the Government, from whom these improvements may be expected. Our job is only to point the way—industry's job is to plunge ahead down the road.

While improvement of personal aircraft is primarily the job of private industry, there are other ways of promoting aviation where the fundamental responsibility rests with CAA personnel.

Along with many other Government agencies and most of private industry, the CAA lost many of its skilled employees to the armed services during the war and finds itself now deplorably understaffed in all departments. In requesting deferments it was necessary for us to concentrate on airways traffic control personnel and other technicians important to the war effort and to look on regretfully as our aircraft inspectors, maintenance men and others, whose activities had subsided with the imposition of private flying restrictions, left us.

Now that personal aviation is coming back fast, we constantly are taking measures to increase our personnel and decentralize our administration in order to give the public quicker and more satisfactory service.

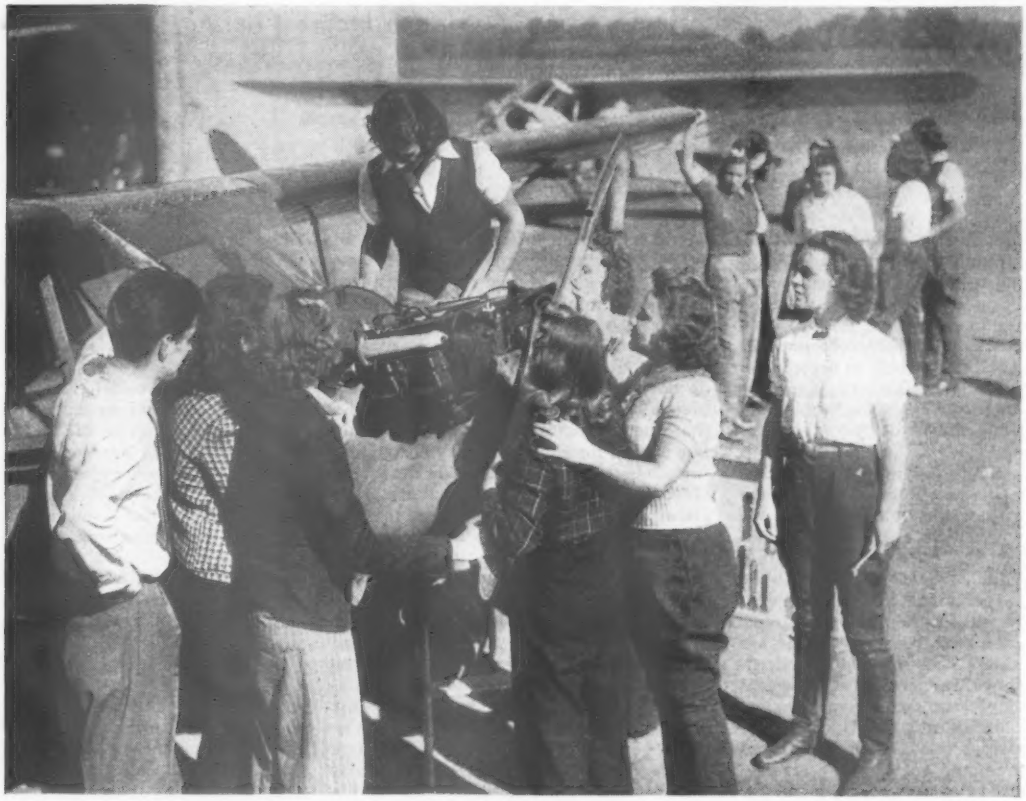
To that end I recently completed a tour of seven of our nine regions and found an appalling situation. Highly-skilled inspectors who were badly needed in the field were spending more than half their time typing, filing and handling routine office details simply because we did not have sufficient clerical personnel. To remedy this situation we plan a substantial personnel expansion by the end of 1946. We now have a total of 11,500 personnel in CAA, with only 10 per cent of them in Washington—an indication of the extent of the decentralization we already have accomplished.

Along with an increase in the number of employees we are requesting appropriations to decentralize our organization even more completely. It is my intention to have a miniature CAA in each region. Thus, assistants to the regional administrators in charge of medicine, private flying, information and statistics and legal matters will execute locally the policies and technical standards we set up at Washington headquarters. Red tape will be eliminated by making on-the-spot decisions rather than awaiting action from Washington.

Although specific funds for this program have not been made available yet we already have two attorneys and four private flying experts established in different regions. The private flying experts will be our fingers on the pulse of personal aviation, supplementing the advice received from the Non-scheduled Flying Advisory Committee. We know that in some communities within given regions there is a great deal of enthusiasm and activity at airports while in other towns, apparently similar, aviation takes a back seat. One of the jobs of our regional advisers will be to investigate the two areas, compare them, and try to foster a uniformly high degree of activity throughout the region. These advisers will also investigate criticism against the CAA and its policies. They will relay the facts to us so we can bring about improvements. We always welcome intelligent criticism from the public and the industry for it enables us to render better service.

I consider that one very important function of the CAA during the coming year will be the reinstatement of the Civil Pilot Training Program, for which we have requested a substantial appropriation. This then would permit us

(*Continued on page* 104)



CAA has requested $3,500,000 to permit reestablishment of a civil pilot training program in co-operation with the colleges. If approved by Congress, the plan would permit 15,000 young persons to start flight training this spring.

CIVILIAN JOBS FOR AIRMEN

By PHILLIPS J. PECK

Staff Writer, International News Service, Washington, D. C.

Hunting a job? Your air services experience will be useful in hundreds of civilian occupations. If you need additional training, you can use the G.I. Bill of Rights to obtain it.

THERE will be a good many thousands of jobs in aviation for returning veterans of the Army and Navy air services, but there are going to be hundreds of thousands of non-aviation jobs. Veterans who feel that they have learned little in the air forces which can help them in non-aviation civilian jobs, will be surprised to know that there are hundreds of occupations in civilian life which are directly related to their military activities.

This article lists 300 such occupations in relation to 35 military specialties of the air forces. It also describes provisions of the G.I. Bill of Rights which will help returning soldiers to get additional training to fit them for civilian jobs. Information given here is current at the time of publication, although a bill is pending in Congress to liberalize some of the features of this legislation.

Before its recent liquidation, the War Manpower Commission prepared a 490-page publication entitled "Special Aids for Placing Military Personnel in Civilian Jobs." It is designed to aid in achieving the fullest possible utilization of returning servicemen in terms of their military training and experience and lists in great detail civilian occupations and their related military occupation specialties.

Since many air force occupations have no exact counterpart in civilian life, the WMC book was designed primarily for the use of employment counselors who have the responsibility for suggesting placement opportunities in civilian life for discharged enlisted personnel who have no extensive civilian experience or training.

Nevertheless, the editors of FLYING

GUIDE TO 300 JOBS

To use chart, locate your air forces occupational specialty at top and trace down columns. "X's" indicate related civilian jobs. You may need more training to qualify for such work but you have a start toward doing so.

have prepared a list of 300 occupations and their related military occupational specialties from this manual. It is a handy reference guide and is meant to supplement and not replace the large manual, which also describes working conditions, physical activities and additional training required for each civilian vocation.

The answer to the second question now being widely asked —what aids are given to returned veterans for vocational training—begins before the serviceman leaves the air services. At posts, camps and stations, the veteran is given a pre-separation processing which goes into his personal affairs on the theory that the services got his affairs into their present shape and is more or less beholden to "demilitarize" the veteran before he goes out into civilian life.

The AAF has a counseling service for veterans about to be discharged, advising them on job opportunities and their prerogatives under the G.I. Bill of Rights. The counseling work usually is done before the veteran reaches the separation center where his discharge is a 48-hour rush affair and the serviceman is least receptive to anything which might delay his departure from the Army.

Even more important is the "separation classification" which the AAF supplies to each discharged airman. This document lists his former occupation in civilian life, his job in the AAF, total education and military background. The separation classification amounts almost to a "diploma" which the veteran uses as an introduction to a prospective employer or to a school where he may wish to enroll for vocational training or other educational work.

After the veteran is formally discharged from the AAF, the Veterans Administration, the United States Employment Service, the Federal Apprentice Training Service or any one of the many state and community agencies takes over.

The Veterans Administration—now under the direction of a top soldier of this war, Gen. Omar Bradley—operates some 200 guidance centers throughout the nation, located in colleges, high schools or vocational schools. Primarily the guidance centers are for the rehabilitation of disabled veterans although any discharged serviceman is entitled to their services.

Under the G.I. Bill of Rights all veterans who had 90 days service, part of which was on or after September 16, 1940, and were discharged under conditions other than dishonorable, are entitled to one year's education, training or a refresher course at any approved United States or foreign school. Moreover, if the veteran's education was interrupted by his entrance into service, he is entitled to continue the education beyond one year for the length of time he spent in service, but not over four years. If not over 25 years of age the Government presumes that his education was impeded by military service and the veteran is not required to submit proof of any interruption.

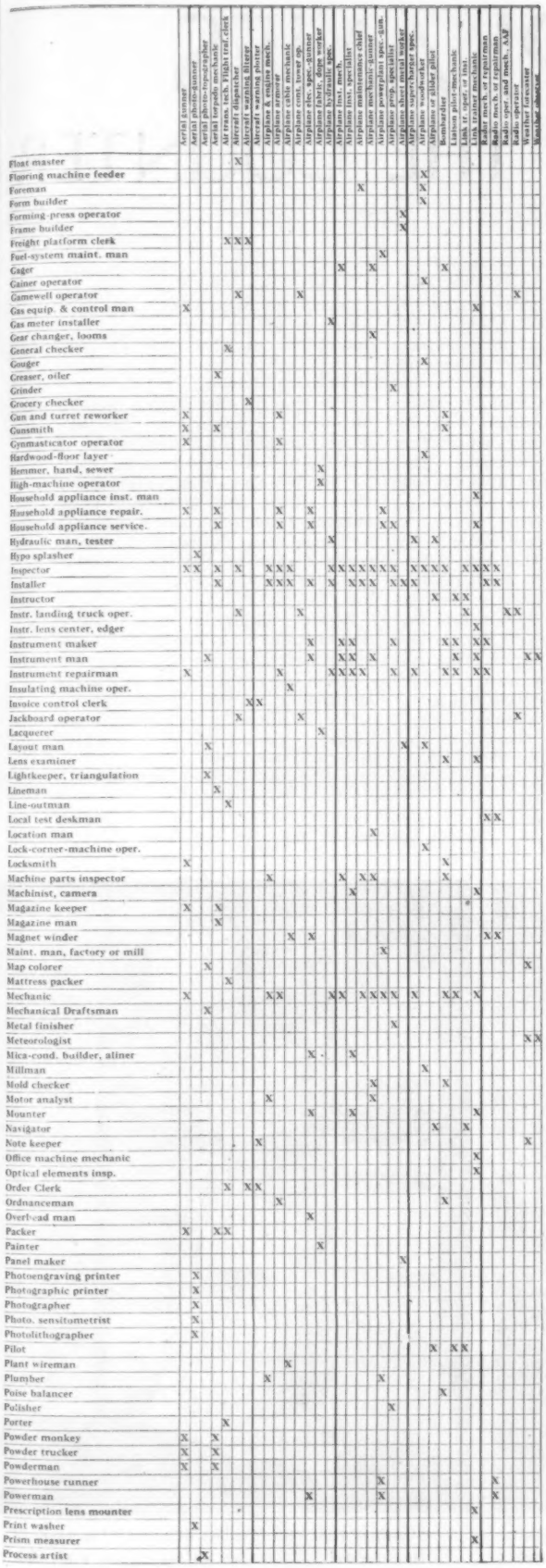
The veteran seeking to resume his education needs only to apply to the school, show his discharge papers and the school authorities apply to the Veterans Administration for the financial benefits to which the serviceman is entitled. The Government will pay the school $500 for an ordinary school year to cover tuition, laboratory and library fees, infirmary and similar costs, books and supplies. The $500 payment does not cover living or travel expenses. The veteran is allowed a living allowance of $50 a month, or $75 if he has dependents.

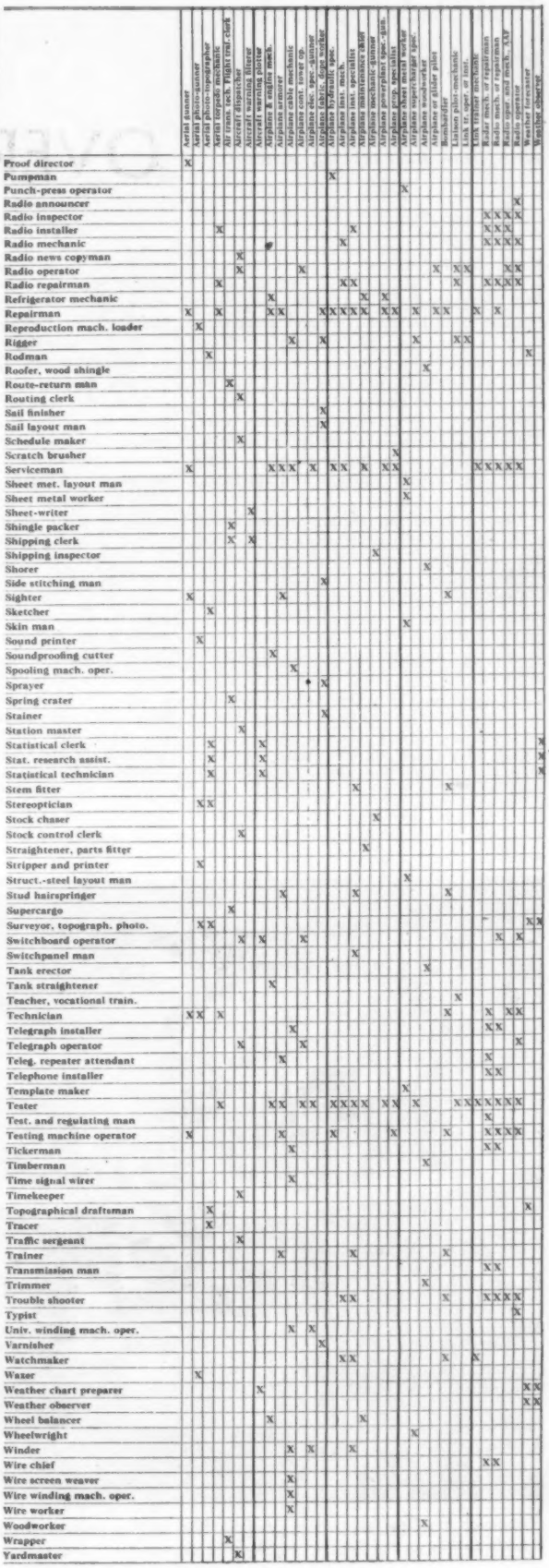
The Veterans Administration also operates a job counseling and employment placement service with representatives in all veterans' offices throughout the country. The service attempts to relate the work performed by the veterans while in the armed forces to the needs of civilian employers.

The returning serviceman also has available to him on-the-job training programs and the Apprentice Training Service. Several hundred employers have contracts with the Veterans Administration for on-the-job training programs and the veteran receives the regular living allowances from the Government plus a wage from the company. These programs

(*Continued on page* 116)

	Aerial gunner	Aerial photo-grapher	Aerial engineer	Aerial torpedo mechanic	Air trans. tech. Flight traf. clerk	Aircraft warning listener	Aircraft dispatcher	Airplane & engine mech.	Airplane armorer	Airplane cable mechanic	Airplane coat. tower op.	Airplane engine tester	Airplane fabric. dope worker	Airplane hydraulic spec.	Airplane inst. mech.	Airplane instr. specialist	Airplane mechanic-gunner	Airplane powerplant spec. gun.	Airplane prop. specialist	Airplane sheet metal worker	Airplane structural spec.	Airplane woodworker	Airplane or glider pilot	Bombardier	Bombsight mechanic	Lin. tr. gnr. or instr.	Link trainer mechanic	Radar mech. or repairman	Radio mech. or repairman	Radio operator	Weather observer	Weather forecaster
Account analyst			X																													
Actuary assist. or clerk			X																													
Adjuster				X					X		X			X	X	X	X	X			X		X	X			X	X	X			
Aircraft mechanic				X				X	X					X	X		X	X	X		X			X	X							
Airdrome maint. chief																									X	X						
Airline captain																							X									
Airplane coverer											X					X																
Airplane first officer																							X		X							
Airport control operator					X	X			X														X		X	X			X	X	X	
Airways observer																										X						
Aligner										X		X		X														X	X	X		
Architectural draftsman			X																													
Armature winder, bander								X	X																							
Armorer	X			X				X															X									
Assembler	X			X				X	X		X		X	X	X	X	X	X	X	X	X			X	X	X		X	X	X		
Assorter															X																	
Attendant																		X										X				
Automobile mechanic								X									X		X		X			X								
Automobile radiator man								X							X				X													
Automobile repairman								X	X		X		X		X		X		X		X							X				
Axle Roller																				X												
Baggageman					X																											
Baggagemaster					X																											
Balance truer																X								X								
Ballistic expert	X																															
Barbed wire machine oper.										X																						
Barrel straightener	X																							X								
Baster, hand												X																				
Beading-machine oper.																			X													
Bench hand								X								X								X								
Blower man								X					X				X															
Board boy					X																											
Boat builder, steel																			X													
Body maker																			X													
Boilermaker																			X													
Boxer				X																												
Brakeman, air or auto								X					X				X			X												
Brass band instr. maker																								X								
Brusher																			X													
Buffer																			X													
Burnisher and bumper																			X													
Burrer, hand																			X													
Bus.-machine inspector																								X								
Bus. machines repairman	X							X																				X				
Bus.-machines serviceman	X												X		X													X				
Cabinet mounter, maker																X					X											
Cable solder, splicer										X																						
Cable stretcher, maker								X		X																						
Calculator			X																													
Call-box wirer										X																						
Camera repairman																								X		X						
Canopy inspector																							X									
Canvas worker											X																					
Carburetor man								X								X	X		X				X									
Cargo handler				X																												
Carpenter																				X	X											
Carpet sewer											X																					
Caser								X								X								X								
Chain-mortiser operator																					X											
Checker				X	X	X	X				X				X	X	X		X					X								
Chucking machine oper.																					X											
Clerk		X		X	X	X	X										X														X	X
Cloth joiner apprentice											X																					
Coil builder, winder								X		X																		X	X			
Combination man																												X				
Compass man		X																													X	X
Compressor, engineer												X																				
Computer, geodetic		X				X																									X	X
Construction-equipment																		X														
Control room man										X														X					X	X		
Co-operative observer						X																									X	X
Core checker																	X						X									
Crop dusting																						X	X	X								
Croze machine operator																					X											
Densitometer reader	X																															
Detailer		X				X																		X								
Dialer																X								X								
Diesel Engine mechanic						X																										
Disassembler						X																										
Disk sander																					X											
Dispatcher					X	X											X							X					X	X		X
Electric-motor analyst											X							X	X							X						
Elec. motor assemb. & test.											X							X														
Electric tryout man			X																X				X									
Electrical inspector							X	X		X				X	X									X			X	X	X	X			
Electrical installer			X					X								X	X	X														
Electrical repairman			X				X	X		X				X	X	X		X	X					X	X		X	X	X			
Electrician							X			X				X	X			X			X			X				X	X	X		
Element setter														X		X																
End rounder																					X											
Engine installer								X						X				X														
Engine man								X						X	X	X		X	X		X			X	X							
Engine mechanic								X						X	X	X		X	X		X			X	X							
Engine preparer																		X														
Engineer											X							X						X				X	X	X		
Expediter				X		X																										
Explosive operator	X		X																													
Fabric worker													X				X															
Filer, hand																		X														
Film technician	X																															
Finisher															X																	
Fire lookout																															X	
Flanger																			X													


Aerial gunner
Aerial photo-gunner
Aerial photo-topographer
Aerial torpedo mechanic
Aircraft & engine mech.
Aircraft dispatcher
Aircraft warning plotter
Airplane & engine mech.
Airplane cable mechanic
Airplane contl. tower op.
Airplane elec. spec.-gunner
Airplane fabric, dope worker
Airplane hydraulic spec.
Airplane inst. mech.
Airplane inst. specialist
Airplane maintenance chief
Airplane mechanic-gunner
Airplane mechanic, turret gun.
Airplane prop. specialist
Airplane sheet metal worker
Airplane supercharger spec.
Airplane welder
Airplane, glider pilot
Bombardier
Liaison pilot-mechanic
Link tr. oper. or inst.
Link trainer mechanic
Radio mech. or repairman
Radio oper. and mech. AAF
Radio operator
Weather forecaster
Weather observer
Float master
Flooring machine feeder
Foreman
Form builder
Forming-press operator
Frame builder
Freight platform clerk
Fuel-system maint. man
Gager
Gainer operator
Gamewell operator
Gas equip. & control man
Gas meter installer
Gear changer, looms
General checker
Gouger
Greaser, oiler
Grinder
Grocery checker
Gun and turret reworker
Gunsmith
Gymnasticator operator
Hardwood-floor layer
Hemmer, hand, sewer
High-machine operator
Household appliance inst. man
Household appliance repair.
Household appliance service.
Hydraulic man, tester
Hypo splasher
Inspector
Installer
Instructor
Instr. landing truck oper.
Instr. lens center, edger
Instrument maker
Instrument man
Instrument repairman
Insulating machine oper.
Invoice control clerk
Jackboard operator
Lacquerer
Layout man
Lens examiner
Lightkeeper, triangulation
Lineman
Line-outman
Local test deskman
Location man
Lock-corner-machine oper.
Locksmith
Machine parts inspector
Machinist, camera
Magazine keeper
Magazine man
Magnet winder
Maint. man, factory or mill
Map colorer
Mattress packer
Mechanic
Mechanical Draftsman
Metal finisher
Meteorologist
Mica-cond. builder, aliner
Millman
Mold checker
Motor analyst
Mounter
Navigator
Note keeper
Office machine mechanic
Optical elements insp.
Order Clerk
Ordnanceman
Overhead man
Packer
Painter
Panel maker
Photoengraving printer
Photographic printer
Photographer
Photo. sensitometrist
Photolithographer
Pilot
Plant wireman
Plumber
Poise balancer
Polisher
Porter
Powder monkey
Powder trucker
Powderman
Powerhouse runner
Powerman
Prescription lens mounter
Print washer
Prism measurer
Process artist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Airplane mechanic-gunner
Airplane mechanic, turret gun.
Airplane prop. specialist
Airplane sheet metal worker
Airplane supercharger spec.
Airplane welder
Airplane, glider pilot
Bombardier
Liaison pilot-mechanic
Link tr. oper. or inst.
Link trainer mechanic
Radio mech. or repairman
Radio oper. and mech. AAF
Radio operator
Weather forecaster
Weather observer
Proof director
Pumpman
Punch-press operator
Radio announcer
Radio inspector
Radio installer
Radio mechanic
Radio news copyman
Radio operator
Radio repairman
Refrigerator mechanic
Repairman
Reproduction mach. loader
Rigger
Rodman
Roofer, wood shingle
Route-return man
Routing clerk
Sail finisher
Sail layout man
Schedule maker
Scratch brusher
Serviceman
Sheet met. layout man
Sheet metal worker
Sheet-writer
Shingle packer
Shipping clerk
Shipping inspector
Shorer
Side stitching man
Sighter
Sketcher
Skin man
Sound printer
Soundproofing cutter
Spooling mach. oper.
Sprayer
Spring crater
Stainer
Station master
Statistical clerk
Stat. research assist.
Statistical technician
Stem fitter
Stereoptician
Stock chaser
Stock control clerk
Straightener, parts fitter
Stripper and printer
Struct.-steel layout man
Stud hairspringer
Supercargo
Surveyor, topograph. photo.
Switchboard operator
Switchpanel man
Tank erector
Tank straightener
Teacher, vocational train.
Technician
Telegraph installer
Telegraph operator
Teleg. repeater attendant
Telephone installer
Template maker
Tester
Test. and regulating man
Testing machine operator
Tickerman
Timberman
Time signal wirer
Timekeeper
Topographical draftsman
Tracer
Traffic sergeant
Trainer
Transmission man
Trimmer
Trouble shooter
Typist
Univ. winding mach. oper.
Varnisher
Watchmaker
Waxer
Weather chart preparer
Weather observer
Wheel balancer
Wheelwright
Winder
Wire chief
Wire screen weaver
Wire winding mach. oper.
Wire worker
Woodworker
Wrapper
Yardmaster

Established operators object to department stores selling planes. Here is a report on this new marketing scheme.

PLANES OVER THE COUNTER

LARGE department stores throughout the nation are breaking out in a rash of plane-selling. Actually, the first airplane sold by a department store was back in 1909 when Wanamaker's of New York and Philadelphia sold for $5,000 an exact duplicate of the plane which Bleriot flew across the English Channel. But it has taken the aviation enthusiasm of World War II and 36 years in between to make department stores generally realize that here lies a golden and growing market.

Today, aircraft are being featured along with shoes, toys, washing machines and the hundreds of other items a customer might include on his shopping list. Although this survey covers only half a dozen leading department stores in the east and middle west, a good many more stores are already in the plane-selling business.

Why this has come about may be something of a mystery to operators who know that selling aircraft is more than taking orders from some innocent passerby who sees this new bright shiny gadget and suddenly wants it for his very own. Even though planes are selling like hotcakes these days, department store executives hardly expect that sales volume from them will approach that from hundreds of commonplace products in demand.

Since department stores aren't in the automobile business, for example, there must be other reasons than outright money-making that brings department stores into the aviation business. The answer, of course, is that aviation has more glamor to a good many people than a $30,000 platinum mink coat.

One thing the department stores seem to be after is "traffic." That little light-plane in the corner of the sports department is a "traffic-getter." It is already proving extremely effective in drawing new people into departments they might never otherwise have visited. For instance, one man came into a store to buy a toy. He ended up by buying a man-sized airplane. Another customer, looking over the airplane display in the sporting goods section, wandered innocently down the wrong corridor and wound up buying an expensive gun.

Besides, stores are capitalizing on the potential publicity value of selling airplanes which, having glamor, also have news. The fact that they sell airplanes proves they are modern and progressive retail establishments.

It is true the department store selling idea brings airplanes down into the most densely-packed areas of cities where many purchase-minded people see them for the first time. But is the department store selling idea altogether good for aviation in the long run? And especially, is it good from the point of view of already-established fixed-base operators? They themselves are unanimous in saying "No!"

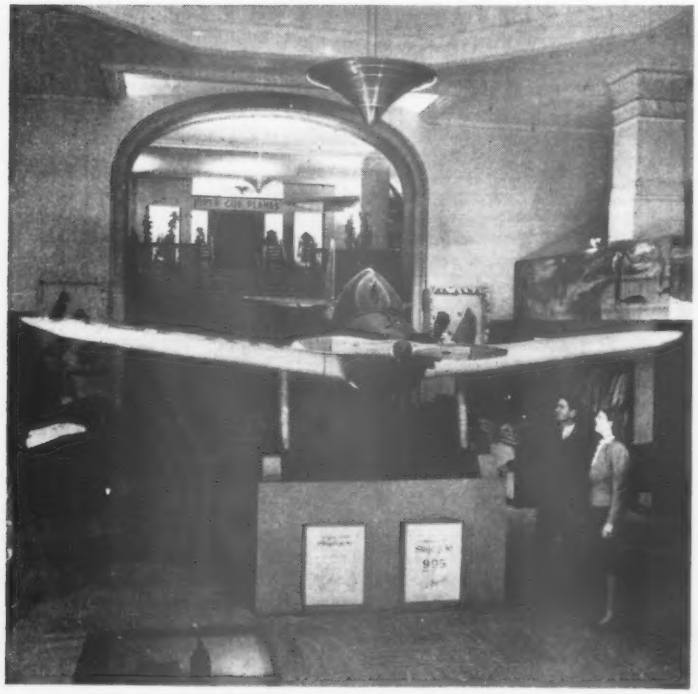
Before looking into these questions, let's consider in more detail the present department store sales setups.

Stores surveyed briefly here are marketing four different types of planes:

R. H. Macy & Co., New York, *Ercoupes.*

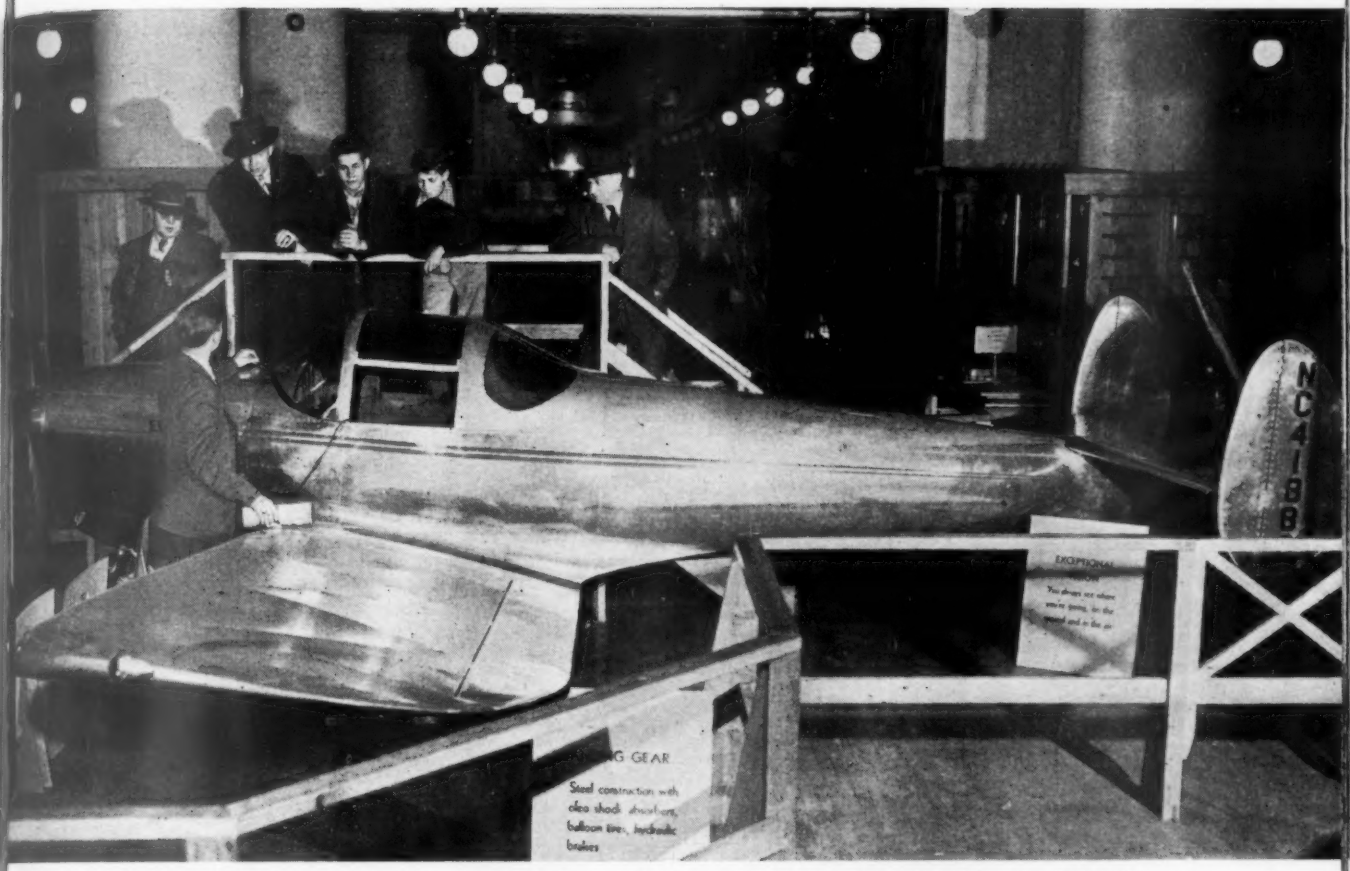
John Wanamaker, New York and Philadelphia, Piper *Cubs.*

(*Continued on page* 110)

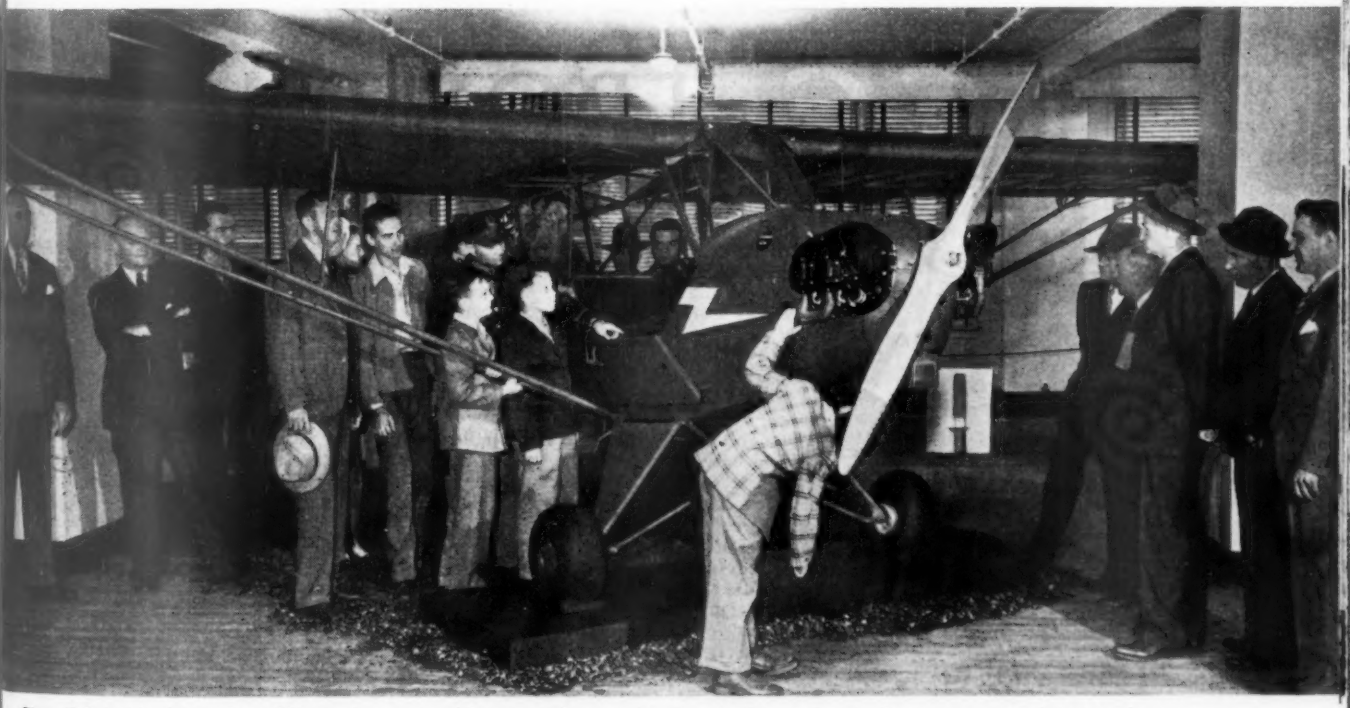


Although this Piper Skycycle is listed for $995 at Wanamaker's, the plane actually carries an NX license, is still under development, and cannot be sold.

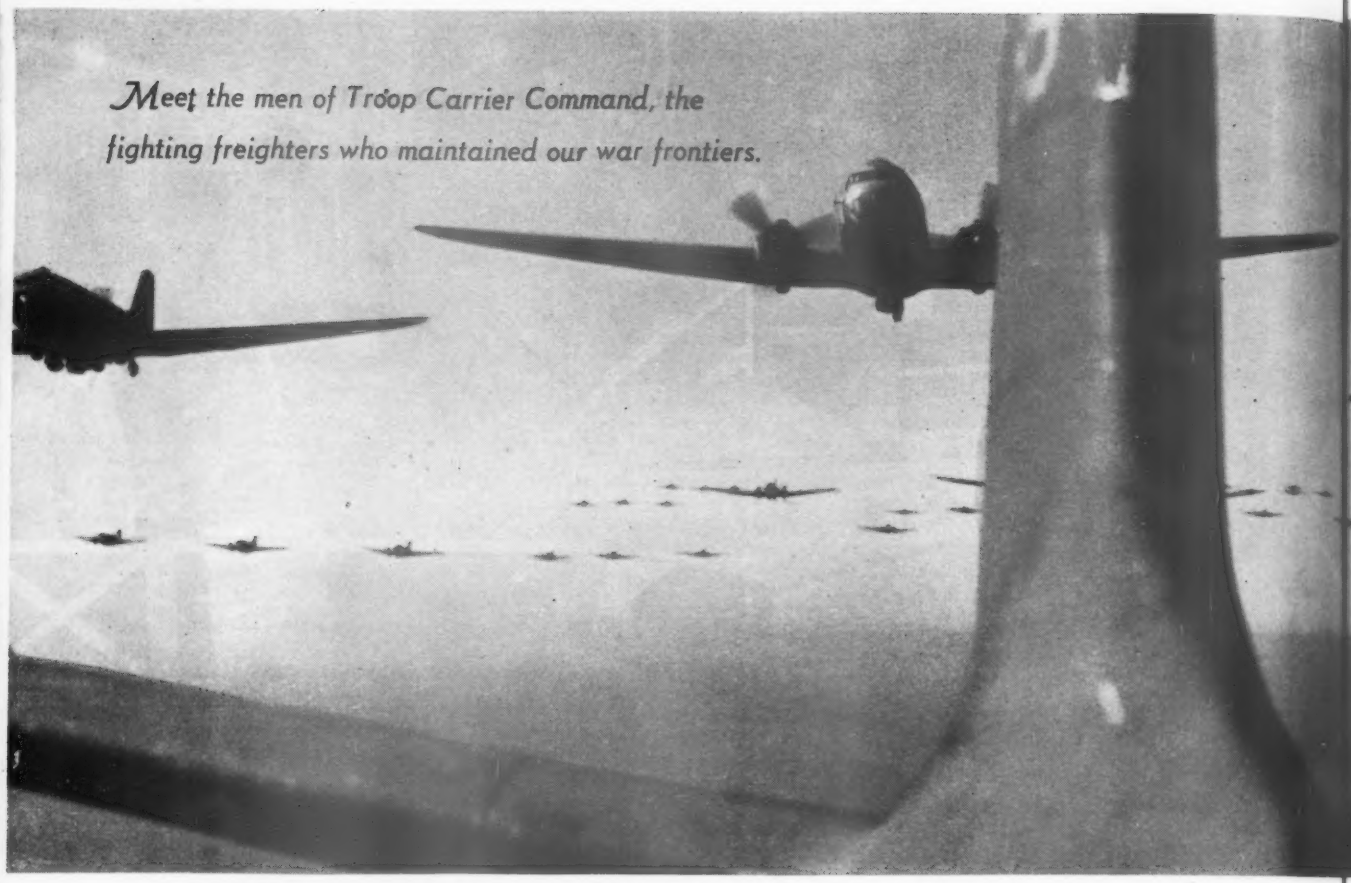
Macy's of New York is selling Ercoupes. Thousands of New Yorkers will pass this window display every day.



Marshall Field, Chicago, sold approximately 40 Ercoupes in the first month plane was on display. In Marshall Field setup, Parks Sales & Service staffs booth, provides repair services, has showroom at airport and furnishes free flight instruction through first solo.



Piper Cub in Mandel Brothers, Chicago, has attracted large crowds, proved to be a traffic-getter. Merchants are not only interested in selling the aircraft they have on display but in drawing new people into their stores and using aircraft as publicity-getting devices.



Troop Carrier Command Skytrain fleets blanketed Axis skies forming a lifeline that supplied combat zones with men, equipment.

TCC FRONT-LINE

By Brig. Gen.
WILLIAM D. OLD
Commanding, First Troop Carrier Command, veteran of 50 combat missions.

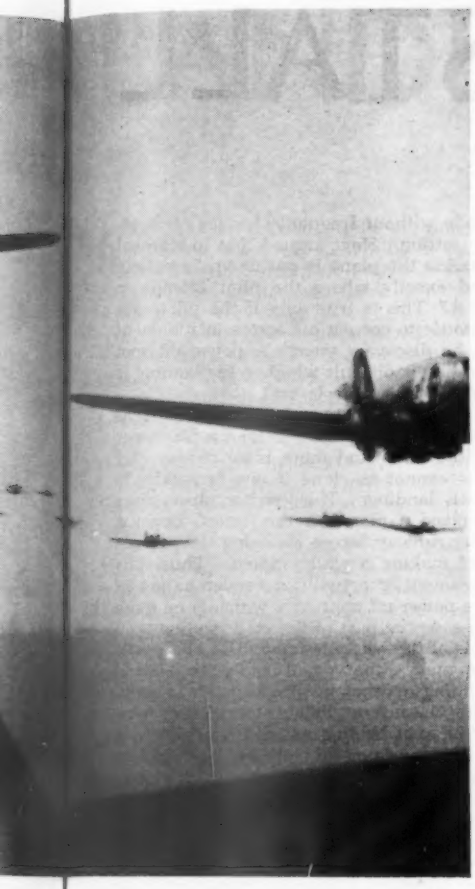
WHEN American occupation forces arrived on Honshu outside of Tokyo, it was fitting that they arrived there in Troop Carrier Command *Skytrains* and *Commandos*. It was a grand climax to the achievements of this unarmed branch of the Army Air Forces.

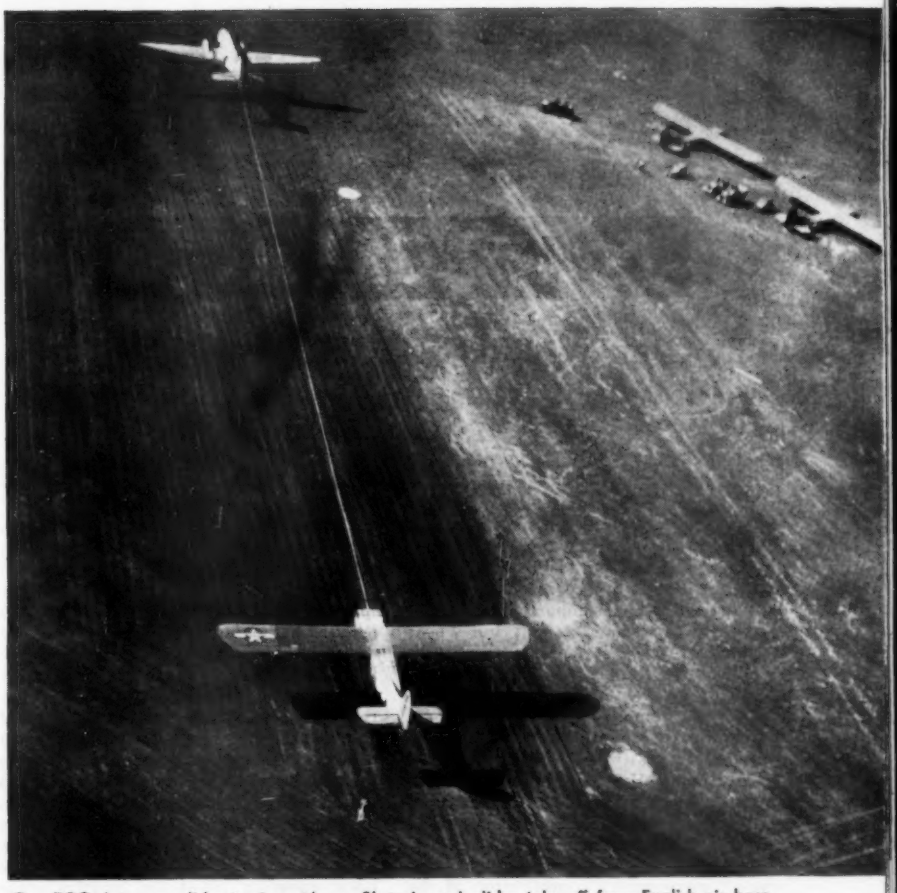
For it was these men who flew the planes that dropped paratroops, towed gliders and carried the vital war supplies which hastened Japan's final defeat. It was a defeat to which they contributed in large measure, their activities extending back three years to the original Troop Carrier Command combat operations of August, 1942, in the Markham Valley of New Guinea.

Often confused with the Air Transport Command—which flew supplies from the United States to combat theaters—the Troop Carrier Command's job began where the ATC's left off. They were Troop Carrier Command units that tied together the vast pattern of American bases, airfields, and islands in the Pacific. They kept the long routes of supply in North Africa constantly covered. They aided in assuring a foothold on the European continent during the Normandy operations and helped to get fuel to our tanks in the dash across France and the Low Countries. They brought relief to our men at Bastogne, Remagen, and Salerno. And they evacuated thousands of battle casualties, enabling our Army Medical Corps to reduce death from wounds to the barest minimum.

Troop Carrier Command—along with Naval Air Transport Service and ATC—was one of the systems which kept the Allied military body sustained and functioning. Through air-lorries such as these, global sky routes were mastered far better than were the interior lines of the Axis powers.

Post-war developments, based on what we in Troop Carrier Command have learned in this war, are of great im-





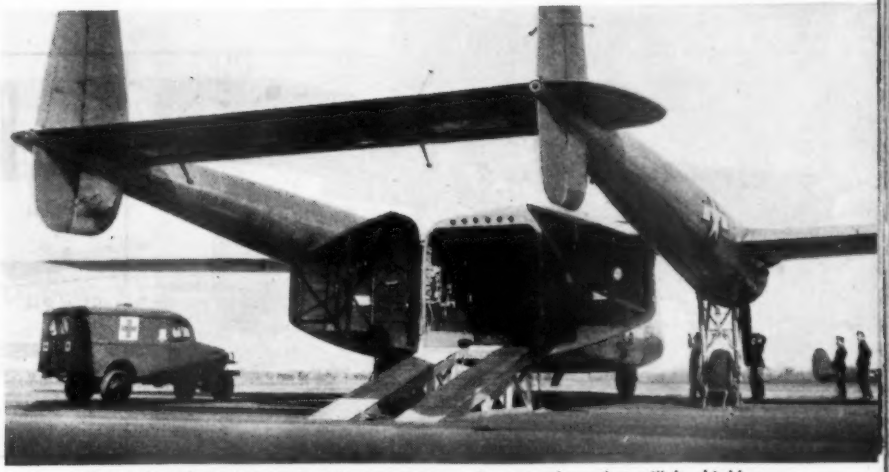
One TCC duty was glider towing. Above, Skytrain and glider take off from English air base.

E · TEAMSTERS . . .

portance to preparing us for the eventuality of any future war or for preventing such wars. We believe that every military division will be trained in airborne operations. While the *Skytrain* was our heavyweight in duties performed during World War II, future military operations point to use of the Fairchild *Packet* and Curtiss *Commando* for long-range transportation of heavy cargo operations. The *Packet*, for instance, will provide cargo space of 2,312 cubic feet, only 550 cubic feet less than there is in a standard railway boxcar.

To illustrate the vital role played by TCC, one need only trace the war record of our pioneer group in the Mediterranean, the 316th. This group fought well in Europe, participating in nine campaigns and winning three Distinguished Unit citations. But for the full story of the Troop Carrier Command, one must also survey operations in the Pacific.

(*Continued on page* 100)



This Fairchild Packet typifies the newer type of cargo plane that will be highly useful in military transport, including supply hauling and serving as aerial ambulance.

THE STALL

IS NOT OBSOLETE

By CAPT. WARREN H. GOODMAN, USMCR

JOHN R. HOYT'S article "Is the Stall Landing Obsolete?" (FLYING, May, 1945) is an interesting discussion of an old question, but his conclusions are a challenge to any pilot who was weaned on the "get your tail down first" technique. Although he organized his article as though it were an impartial discussion of the pros and cons of stall and wheel landings, his very statement of the subject indicated that his conclusion would be: "The arguments for the wheel landing are much more valid and numerous than those for the full stall."

There is much to be said for the stall landing which Hoyt left unsaid. To begin with, his definitions of the two types of landing were so designed as practically to close the case. Each of his definitions took two long paragraphs which was an unnecessary complication of the question. There is but one basic difference between a stall landing and a wheel landing. Each is composed of two essential elements: 1. The gradual reduction of the airspeed of the plane from a safe flying speed to a stall; 2. Placing the wheels of the plane on the runway.

If these two things are done in the order named, the landing is a *stall landing*. If the wheels touch the ground *before* the plane stalls, it is a *wheel landing*. With this simple distinction in mind, we can proceed to the arguments against the stall landing.

Hoyt stated that the stall landing involves a slower gliding speed which is inherently unsafe. No pilot will deny the hazards of near-stalling-speed glides, but a slow gliding speed during the approach is *not* an essential part of the stall landing. The only time that a slower speed is necessary using stall technique is during the last 10 or 15 feet of the descent when the nose of the plane is being pulled up to bring the plane to a stall. A miscalculation of speed and a resultant premature stall at that point would probably result in nothing more disastrous than a rough landing. During the actual approach, when a slower speed would really be dangerous, there is no difference between the type of glide called for by either type of landing. Thus we can rule out as irrelevant to the basic question all of the lengthy arguments against the stall landing on the basis of the speed of glide.

The second accusation against the stall landing is that it is inaccurate, or using Hoyt's definition: "The plane lands, usually, at a spot that varies considerably because of wind, accuracy of glide, number of r.p.m.'s at engine-idling speed, and the ability of the pilot to hold the plane off until the wing is fully stalled."

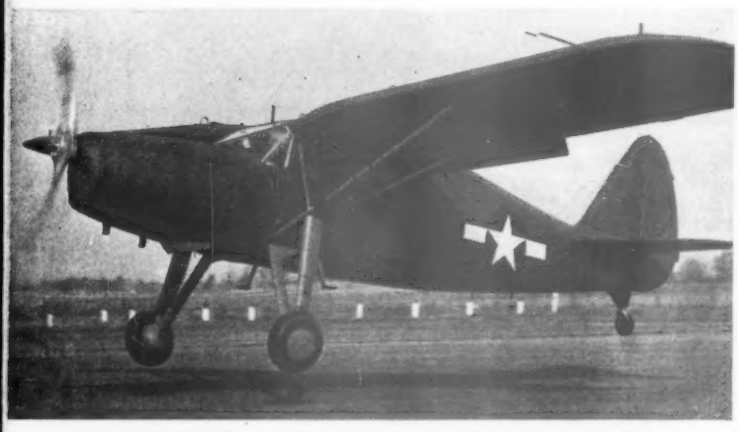
This is usually true in a throttle-off landing and if the throttle is untouched during most of the approach and glide. But it is also true of a wheel landing made without frequent changes of throttle setting. Hoyt argued that in a wheel landing the plane is put down "precisely and exactly where the pilot intends to land." This is true only if the pilot uses throttle to correct his errors in judgment as he discovers them. A power-off spot landing is difficult whether the landing is full stall or wheels first.

It is true that on long runways it is generally convenient to land a bit closer to the line. And there is no reason why this cannot be done if one is making a stall landing. This writer has often dragged a plane on the "prop" down a long runway before chopping the throttle and making a stall landing. Thus, this argument is actually a condemnation of the power-off approach, which is no more an essential part of the stall landing than it is of the wheel landing. Use of throttle can make either a stall landing or a wheel landing a smooth precision maneuver. The inaccurate, difficult-to-execute, power-off spot landing which is under attack is *only one type* of stall landing, and can fairly be compared only with the *same* type of wheel landing, which is just as inaccurate.

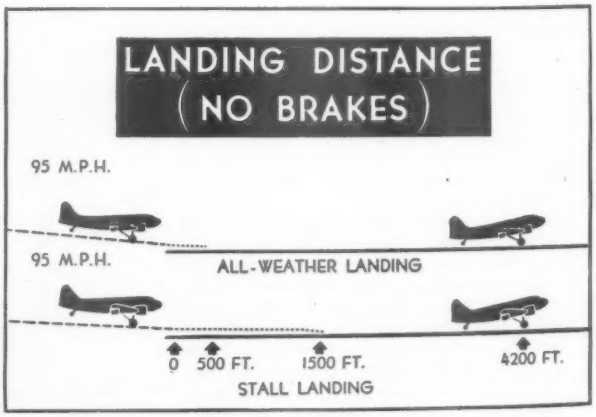
Hoyt's third main argument was that the stall landing is harder on the airplane. He presented intricately-worked-out figures to prove that a plane stalled from two feet off the ground "strikes the ground as hard as a plane would hit if the pilot flew it right on in at 680 f.p.m. descent without breaking his glide." He arrived at this figure by "assuming a free drop from a stall" and computing the acceleration due to gravity. His figures are quite impressive until they are analyzed.

This assumption is his first fallacy. When a plane stalls, it does not have sufficient lift to keep it in flight—but it *does* have some forward motion, some airflow

(*Continued on page* 106)



This Fairchild UC-61K is about to land using the full-stall technique. Glide is broken close to ground, plane assuming stall attitude as it drops on runway.



Assuming identical approach speeds, chart shows distance of unbraked landing roll is same for wheel and stall landings.

LANDING . . .

IS OBSOLETE

By JOHN R. HOYT

AS LONG as the average pilot is thinking he is improving his ability to fly safely. Anyone can be taught to fly but one must do his own thinking if he wants to fly very long.

On the other hand, some of the points in my recent article, "Is the Stall Landing Obsolete?" (FLYING, May, 1945) must not have been stated too clearly. Many letters in response were abusive, some derogatory, while still others indicated that the writers were holding to their own type of landing, not for logical reasons but merely because they had been *taught* that way.

An old method is often very good. Nevertheless, we are forced to examine, from time to time, newer ways and methods in order to forge ahead. Our aim should be this: let's fly the safest, easiest, and best way. Let's examine the subject because we are eager to learn and anxious to improve our technique.

FIRST. NACA has granted permission to use reference test data on landings. Readers are invited to consult the NACA Technical Note No. 863, entitled, "Results of Landing Tests of Various Airplanes." The results of these interesting experiments will be referred to below.

T.N. No. 863 includes data on landings made by experienced pilots in 21 different types of aircraft. The maximum vertical velocity attained in these experiments was 600 feet per minute. This corresponds to the velocity of a freely falling body from 18 inches—*1½ feet.* The maximum number of "G's" was four.

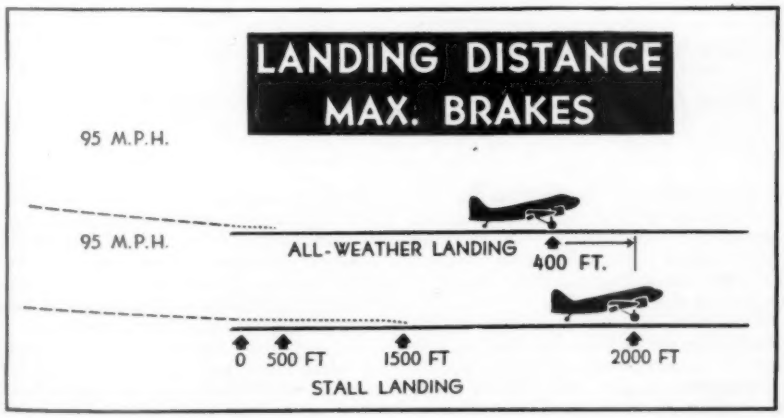
Further data indicates that it is impossible to compute how hard a plane will strike the ground if it is stalled from three, 12, 24 inches, or any other height. There are too many factors to be considered, such as landing gear design, shock absorbers, wing loading, lift coefficient, etc. In the NACA tests, sinking speed varied not only in each of the 21 different planes but in each landing.

To compare the vertical velocity of an airplane in a stall with that of a freely falling body therefore invites criticism. Yet, in any discussion on safety, we must obviously assume that maximum values will exist. For instance, it wouldn't do to say, "Your lightplane may stall and land at only one G, but on the other hand it may accelerate four G's." It is possible for a plane to strike the runway with the force of a freely falling body.

Consider still other experiments: landings made on the wheels were made with a maximum of 1.7 G's. Thus comparison may not be altogether fair because a wheel landing is made at a time when the lift derived from the wing is enough to sustain the aircraft. But isn't that what we are after: a safe, smooth, easy landing?

SECOND. Impact during a wheel landing depends upon rate of descent. Many pilots believe that forward speed affects the impact; for example, at 200 f.p.m. descent with a forward speed of 40 m.p.h. the plane would strike the ground at approximately the same force as if it were dropped from two inches. At the same rate of descent, but at 80 m.p.h., it would strike the ground no harder than before. The reason is this: the faster the approach speed, the flatter the glide.

(*Continued on page* 108)



Using maximum brakes, stall landing requires 400 feet more runway than wheel method. Touch-down point in former might be as much as 1,500 feet past runway's approach end.

Section of motion picture film shows airliner making a wheel landing, in which plane is flown onto runway.

Airminded Wichita is one city that is planning its future airports now. Here is a projected airpark in the north Wichita industrial district adjacent to Wichita's huge stockyards, grain elevators, oil refineries and other plants which will use it for business purposes.

Planning YOUR HOME TOWN AIRPORT

Planes are expected to increase 10-fold in the next 10 years. Plan for them now; by 1956 it will be too late.

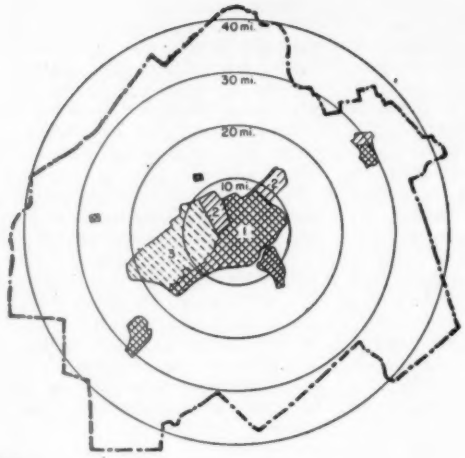
THERE is a growing conviction that if any metropolitan area is to have a dynamic and progressive future it must plan continuously, positively and comprehensively. It is becoming increasingly obvious that plans for airports must be integrated into general plans for both rural and metropolitan areas.

The Civil Aeronautics Administration has recognized the need for airport planning in city areas by its recent pamphlet "Airport Planning for Urban Areas," from which most of this article is condensed. Additional recognition to this need is given by CAA in the creation and expansion of its Airport Service which maintains an Urban Planning Section ready to consult with official planning agencies in the larger cities.

With a 10-fold increase expected in private aircraft in the next 10 years, the need for airport planning becomes doubly evident. New airport facilities will be in tremendous demand. And the time to plan for them is now.

So far, the attention of most municipal authorities has been directed to planning for transport planes. But the more important phase—at least from the viewpoint of numbers—is planning for the 297,000 private planes expected by 1955. Planning for private aircraft so far has not received the attention it deserves.

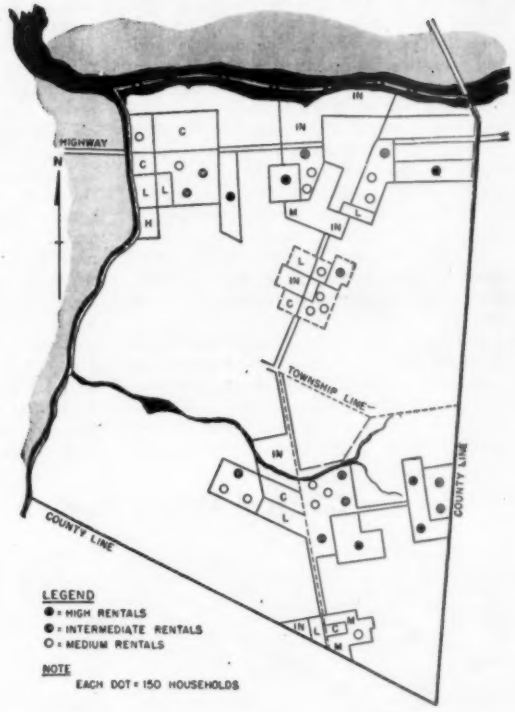
For example, how many airports and of what types will each state require? How many of these must be planned for rural areas and how many for urban centers? In cities, how many airports and of what types will best satisfy specific



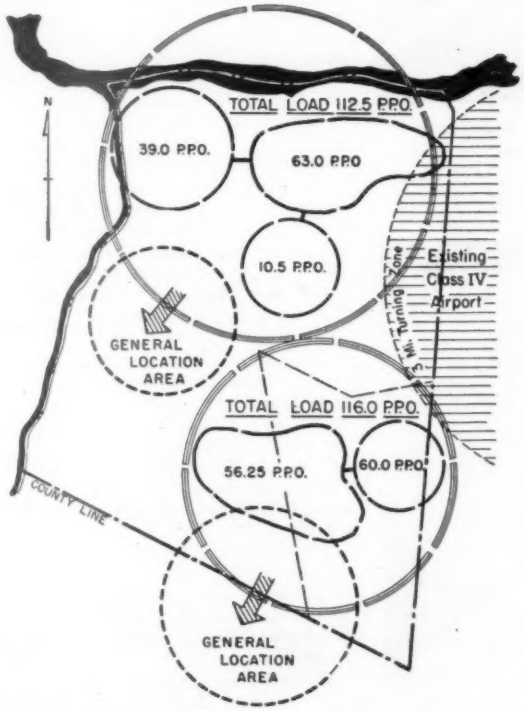
LEGEND

- ZONE NO. 1 – POP. 2,000,000. – DENSITY HIGH – SURFACE TRANSPORTATION EXCELLENT – WEALTH DISTRIBUTION GENERALLY LOW BUT HIGH IN SPOTS.
- ZONE NO. 2 – POP. 100,000. – DENSITY FAIRLY HIGH – SURFACE TRANSPORTATION VERY GOOD – WEALTH DISTRIBUTION VERY HIGH.
- ZONE NO. 3 – POP. 250,000. – DENSITY LOW WITH CONSIDERABLE OPEN LAND – SURFACE TRANSPORTATION GOOD – WEALTH DISTRIBUTION HIGH.
- ZONE NO. 4 – POP. 650,000 – DENSITY LOW, LOTS OF OPEN LAND – SURFACE TRANSPORTATION POOR – WEALTH DISTRIBUTION SPARCE BUT HIGH IN SPOTS.

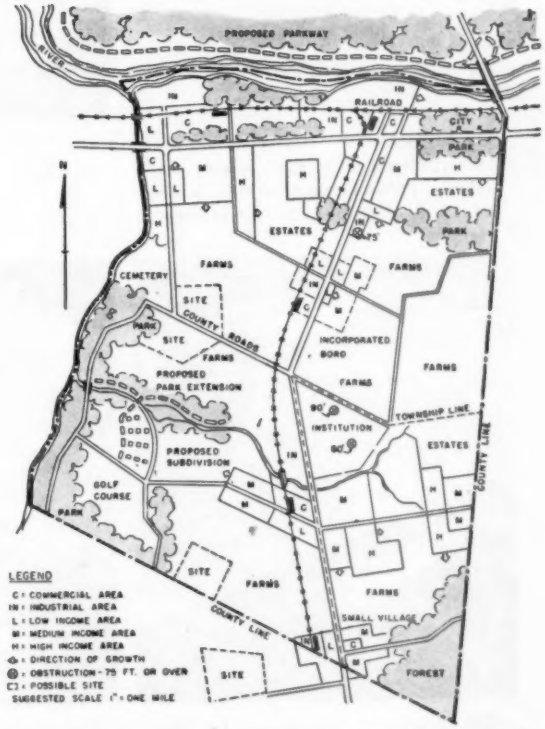
After an analysis of this large metropolitan area, planners conclude that Zone 3 offers the best possibilities for new airports.



As a preliminary step to airport planning in this area, a survey of rentals is made from census figures as outlined in the text.



Another planning step results in determining number of potential plane owners based on rental survey, and indicates general location area of future airports considering the existing large port.



Detailed surface maps are now prepared which indicate likeliest available sites for future airports. Planning engineers must consider factors of land costs, transportation and potential use.

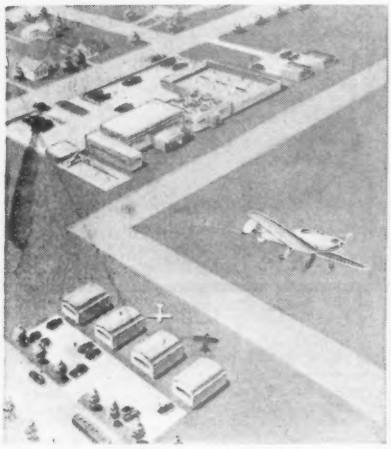
conditions of location, topography, population and industrialization? Where do potential plane owners live and can landing facilities be provided within convenient distance of their homes? Where will privately-owned planes most likely go, and will landing areas be available when they get there? How many planes can be accommodated on an airport of a given size? Should preference be given to the construction of a few large airports or of many small ones?

Unless the city studies, analyzes and answers these questions the plan is inadequate and waste and inefficiency will result.

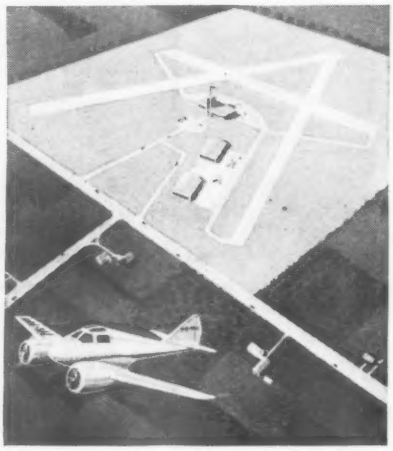
Probably the most obvious factor influencing the location of an airport is its proximity to the ultimate destination and source of passengers and cargo. The ability to cover great distances in a short space of time most often is cited as the outstanding attribute of air transport. It is natural, therefore, that the proximity (in point of time) of a major airport to the destination and source of passengers and freight is of paramount importance. Such "time" proximity usually overshadows considerations of distance alone. The location of the major airport with respect to high-speed highways, rapid transit and railroad facilities, possible speedboat routes, and even possible helicopter and aerial taxi routes, must be carefully explored.

The location of a smaller airport serving the private plane, it is believed, will be influenced strongly by the whereabouts of the potential airplane owners. The actual or supposed objections to such airports placed in the vicinity of a residential area are likely to disappear as demand for developing such facilities close to the flyers' homes increases.

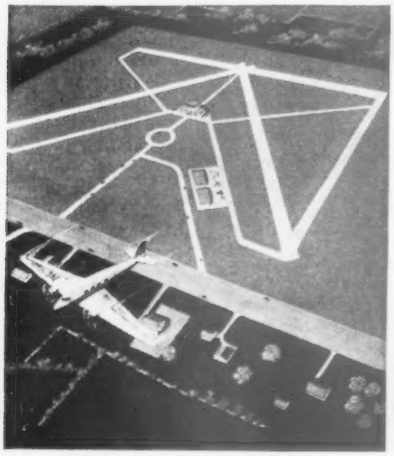
Five Classes of Airports Handle All Sizes of Planes



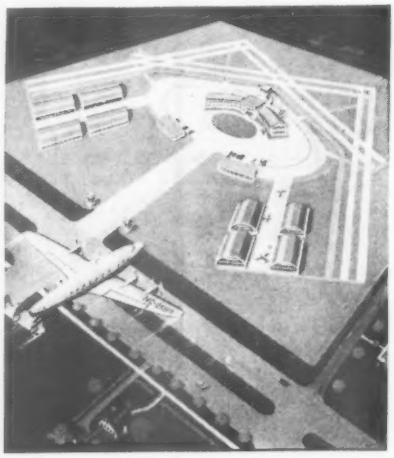
Class 1 airport or "airpark" is designed for lightplanes up to 4,000 pounds gross weight. Without paved runways, landing strips are 1,800 to 2,700 feet in length.



Class 2 ports are designed for communities of 5,000 to 25,000 population and planes from 4,000 to 15,000 pounds. Paved runways should be 2,500 to 3,000 feet long.



Class 3 airport is big enough for cities of 25,000 to several hundred thousand. It will accommodate present day transports and has runways 3,500 to 4,000 feet long.



Class 4 and 5 airports serve major cities and accommodate largest planes in use or planned. Runways are at least 4,500 feet for Class 4 and 5,500 feet for Class 5.

Since airports are an integral part of the community, whether municipally or privately owned, they are subject to the same community planning principles and policies as other elements in the master plan and must be co-ordinated with existing as well as planned features. Especially important is the provision of adequate water supply, sewerage, electric light and power, fire and police protection. Attention must be given to the possible effects of the airport on land use in the contiguous areas and vice versa. The relatively vast area of an airport, as in the case of a large park or golf course, may provide a barrier to the extension of the arterial highway system as well as the street pattern. An attempt should be made to select sites which will have the most desirable effects in this respect.

The provision and protection of adequate approach zones will necessitate more or less restrictive height zoning of areas near the airport and in line with the landing strips. In a few instances restrictive use zoning may also be needed. In general, however, the territory between the approach zones will lend itself to more intensive community development, frequently to a complete neighborhood development. The more restricted areas in the approach zones, especially the open areas near the airport boundary, then may be found useful as playground and recreational areas for these neighborhoods.

The recommended glide path ratios and the area of the approach zone vary for the different classes of airports (see page 34) and for the respective landing strips, depending upon the use to which they will be put. For Class 1 (small, private-owner type) fields, approach zones should provide a glide path clear of vertical obstructions at a ratio of 20-to-1. The approach zone should have a width of 500 feet at the end of the usable landing area and 2,500 feet at a distance of two miles out, with the center line of the approach zone a continuation of the center line of the landing strip. (These glide path ratios do not restrict the use of land to the extent that may be supposed at first glance. A 20-to-1 slope, for instance, is 132 feet above the horizontal one-half mile from the airport boundary. That is higher than a 12-story building).

For normal usage on Class 2, 3 and 4 fields (which are for progressively larger planes than the smallest private-owner types), the recommended dimensions are the same but the glide path ratio should be 30-to-1. For instrument runways on the larger fields the glide path ratio should be 40-to-1, and the approach zone should be 1,000 feet wide at the end of the usable landing area with a two-mile-distance width of 4,000 feet. Where parallel runways are contemplated the widths of approach zones should be increased proportionately to provide relative clearances.

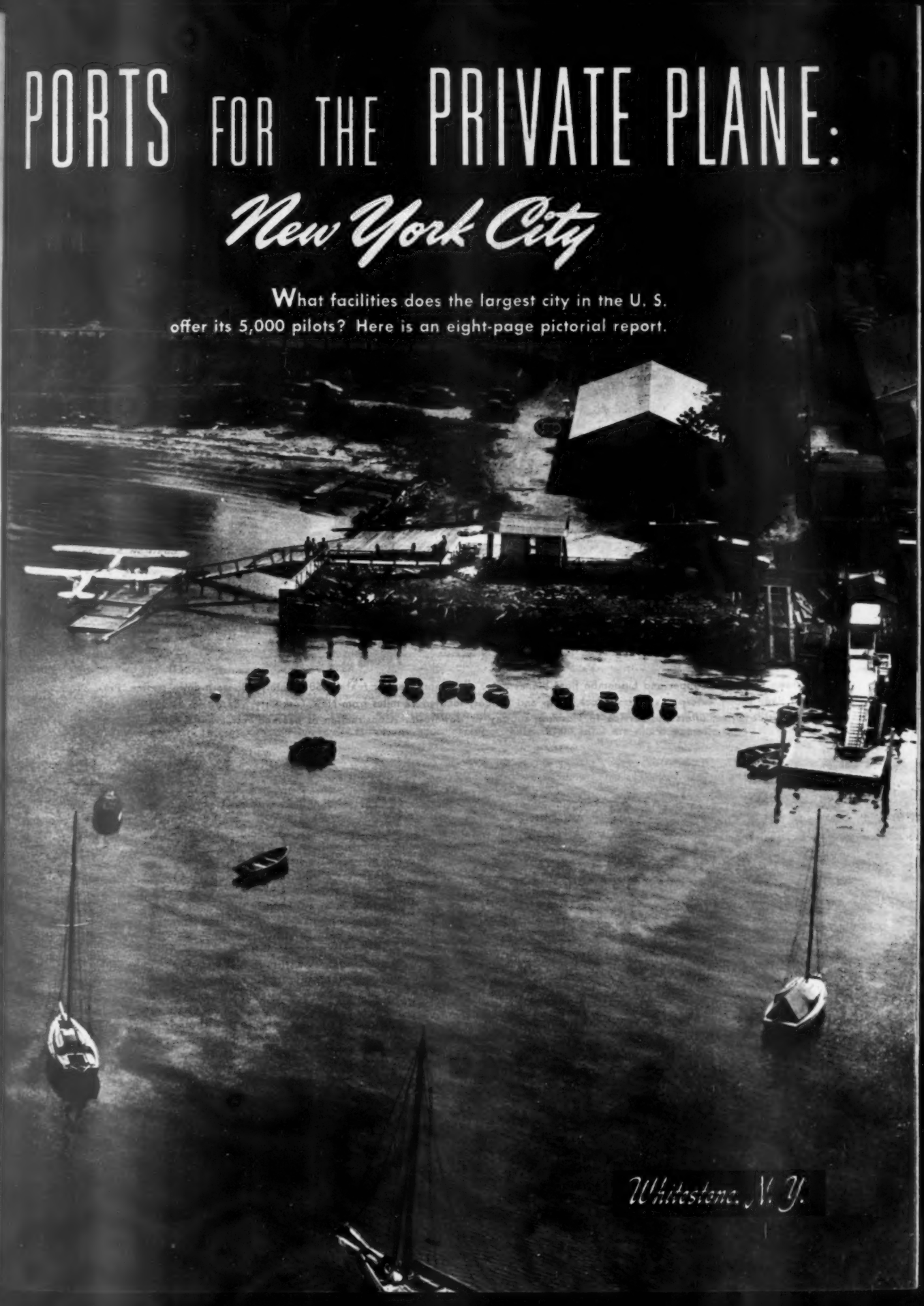
Standards relating to airport size are fairly definite. Those for appraising any specific location of necessity are more general in character and are intended to serve mainly as a summary of the factors

(*Continued on page 96*)

PORTS FOR THE PRIVATE PLANE:

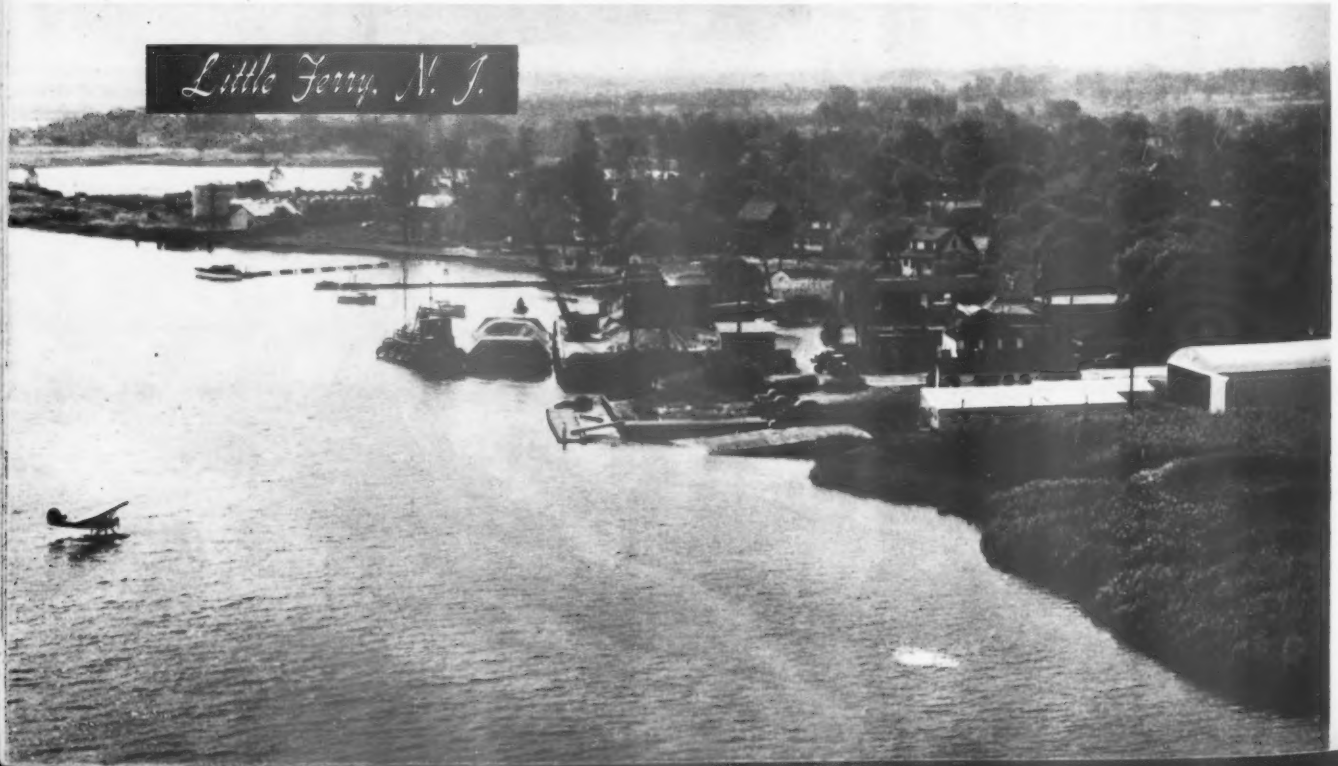
New York City

What facilities does the largest city in the U. S. offer its 5,000 pilots? Here is an eight-page pictorial report.



Sod field and runways, complete aircraft and engine service is offered at Teterboro Air Terminal. Airport (above) accommodates 40 privately-owned aircraft plus seven planes operated by Safair Flying Service, whose flight office (right) is meeting place for pilots. About 800 pilots fly from this field. Location is 13 miles from downtown Manhattan. Available transportation includes train, express highway and subway.

Hackensack River Little Ferry seaplane base (below), is operated by North American Flying Service. Six miles of river without bridges in area afford good take-off, landing space for 200 students using four Aeroncas. Port is 11 miles from Manhattan, two miles from Hackensack. Transportation is poor; nearest bus line is half-mile away. Dual and solo rates are average for this region.



Level plain of Staten Island Airport is carved from wooded area (below). Skyservice operates nine airplanes from this field, has modern, clean hangars with concrete floors. Transportation consists of bus (on highway in picture) to Eltingville station, train to St. George Ferry, boat to New York. Charge for lightplanes, like Aeronca tandem trainer being refueled (above), is average.

consists of some combination of bus, surface trains, subway or ferry-boat. In a few cases no public transportation whatever is available at the field, leaving the pilot either to hitch-hike or hire a taxicab. Eating establishments (if any) are generally second-rate and rest-room comforts are inexcusably limited.

From information obtained at each field and waterport, a better view of the individual facilities was obtained. The following statistics may be used as a yardstick of comparison.

WHITESTONE, L. I., is location of Queens Seaplane base, one mile east of the Whitestone Bridge. The operator here stated that his one instructor handles an active list of 150 student-pilots, using two 1941 Piper *Cub* seaplanes. Their rates are $11 dual, $9 solo per hour, which represents an average rental charge for the New York area.

Hangar rent for light seaplanes (Pipers, Luscombes, etc.) is $50 monthly, which includes a washdown after each flight. Transient seaplanes are hangared overnight for $3 nightly. Transportation to downtown New York consists of a bus line,

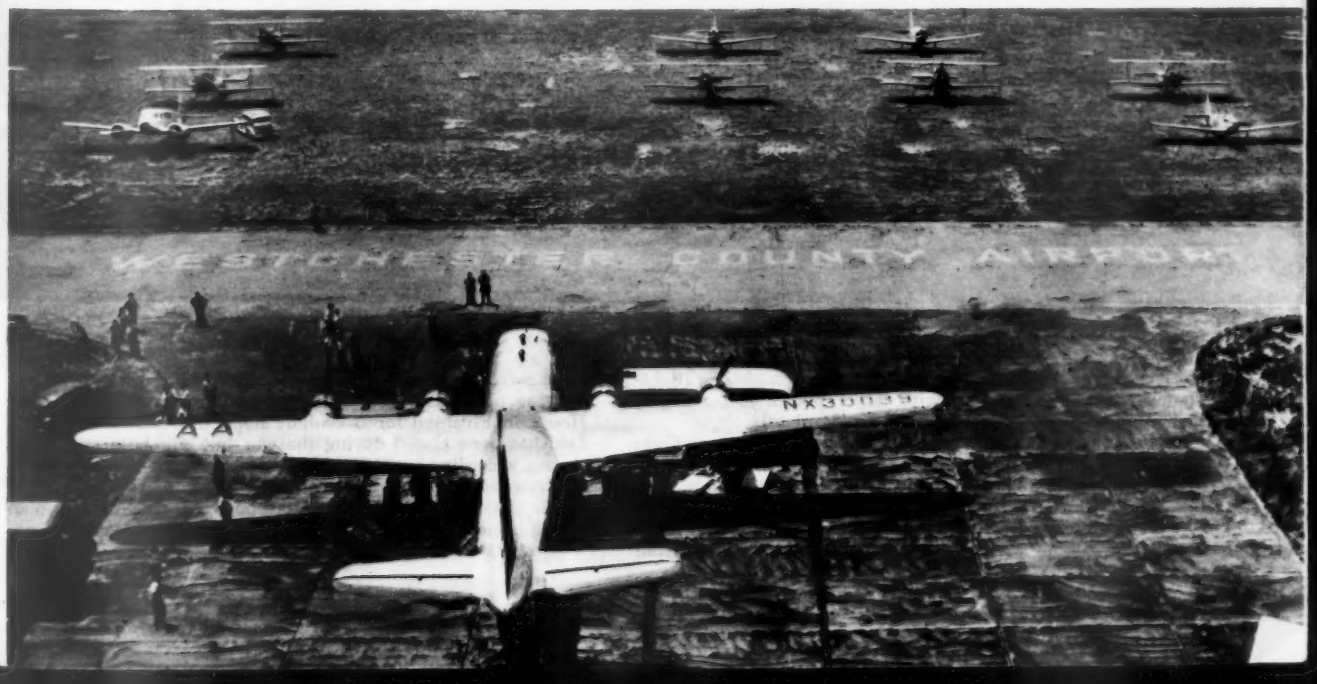
Ninety-two acres comprise Murchio Field (above), seven miles from Paterson, N. J., 23 miles from New York City. Hangar rental is average for vicinity plane rental of four Cubs at field, slightly lower. Facilities consist of three metal hangars and combination flight office and restaurant in frame building at left (below). Eight privately-owned planes are hangared at this field.

three blocks from the base, to Flushing, from where the subway is used to reach Manhattan. At present no overnight cabins or hotels are available, although the operator states that plans for a hotel are in the formative stage. Future plans also include construction of a bar, restaurant, music pavilion, and clearing an area for a bathing beach.

FLUSHING, N. Y.'s airport is the base of one of the largest operators from the equipment standpoint—Speed's Flying Service, which operates 14 aircraft. Manager Anthony Hanzlick states that approximately 75 active students are handled by one full-time and four part-time instructors. The aircraft include *Cubs* that were surplus L-4 liaison craft, an Aeronca *Chief*, Waco UPF-7 and two Waco cabin planes—even a 1928 taper-winged Waco used for sky writing. Lightplane rental is $11 dual, $9 solo hourly. The open-cockpit Waco rents for $20 dual per hour, $17 solo.

Monthly storage rental here is $35 for lightplanes, while storage for Beechcrafts and Stinson *Reliants* is $45 per month.

A picture airport is suggested by view of Westchester County Airport (above). Field's glamor is marred by lack of restaurant, hangar facilities (tie-down, $1.50 nightly), no public transportation, hour's train ride to New York. Concrete taxistrips, ramps, excellent runways (shortest runway, 4,500 feet), can handle planes from Cubs to giant four-engined transports (below).



Westchester Airport, not to be confused with the deluxe Westchester County Airport, is 30 miles from downtown New York. Port has typical small-field grass runways and dirt taxistrips (above.) Cub hourly rates, $10.29 dual, $8.29 solo. Field has metal hangars, pilot lounge (far end of field, below), restaurants on other side of highway. Bus and train ride to New York City requires one hour.

Overnight storage is available at $1.50 per night for lightplanes (Stinson 105 is $2), with larger planes $3 per night; twin-engined aircraft are hangared for $4 nightly.

Edwards Flying Service, at the same airport, has three *Cubs* and one Taylorcraft, all of which rent for $9 per hour solo and $12 per hour dual. No hangaring facilities are available with this operator for either permanent or transient aircraft.

Although the field is but nine miles from downtown Manhattan, travel time is about one hour, using bus service (from the field) to Flushing and the subway from there downtown. Visiting pilots may use either the Sanford Hotel or Overton House in Flushing for overnight stops. A restaurant on the field has been closed during the war but will be opened this spring, according to the operator.

TETERBORO, N. J. If information obtained there is accurate, Safair Flying Service at the Teterboro Air Terminal is one of the busiest in the area. Four *Cubs*, two Aeroncas and one Waco UPF-7 are now being used (*Continued on page* 90)

MY FLYING BEGAN AT 55

By H. E. COTTER

Do you think you're too old to fly at 50? Nonsense, says this businessman executive.

Author (right), and instructor Danny Dudash, in "Miss Bubbles" at Sky Harbor airport. One day after receiving a private license, this pilot began a solo 3,600-mile trip.

IT MUST have been the prolonged ribbing from my friends that increased my determination to become a lightplane pilot. A group of sportsmen friends had me penned in a train drawing room enroute to our favorite hunting grounds. Friendly repartee placed me on the receiving end, for I—at the age of 55—had begun to take flying lessons.

Impressive arguments to prove that flying was a "young man's game" were tossed at me from all sides. One party member insisted on reading out loud an article by Wesley Price in an issue of the *Saturday Evening Post* relating his trials, tribulations and expenses in making a New York-New Orleans round trip by lightplane. While I don't recall all the details, I do know that the author was attempting to convey the inconvenience and expense of lightplane travel. The more my friend read, the more everyone laughed. That is, everyone but me.

Upon my return to Chicago, I hurried out to Sky Harbor airport in Northbrook, Ill., where I sought the advice of Bill Turgeon, operator of that field. I related the incident and my reactions to my instructor, Danny Dudash, a former civilian Navy instructor and to Lu Savage who runs the airport office. My tale fell upon sympathetic ears, for I was assured that age was no barrier to lightplane travel and Danny assured me that "pilot sense" and "lightplane savvy" could be acquired by a diligent student.

So I did all the things that Dudash told me to do—learned what co-ordination meant, watched altitude and r.p.m.'s with a careful eye, boned over navigation problems, probed sectional charts and studied the habits of cloud "families." It all led to my first nibble at cross-country flying. Danny drubbed into me the importance of properly charting a course and of marking off 10-mile intervals on the course line. This was more like it. It certainly was better than constant-bank eights and touch-and-go landings in a Piper *Cub*. It was what I, like every puddle-jumper pilot irrespective of age yearns for—the chance to get in a little plane and go places.

With the time approaching when I would try for my private pilot's license, I began to shop around for a little plane that would accommodate my wife and me. Bill Turgeon located an *Ercoupe* for me. On February 2, 1945, I purchased it and christened it *Miss Bubbles* after my strawberry blonde—Mrs. Cotter.

Before I could get acquainted with my aerial flivver I was called to Sarasota, Fla., on business. While there I kept my hand in by flying around in *Cubs*. Then I phoned Dudash to ferry my *Ercoupe* to Sarasota, where he introduced me to an airplane with no rudder foot controls. I finally soloed it with my feet groping around the floor for a rudder pedal everytime I made a turn.

Then and there I determined to have *Miss Bubbles* changed over to a three-control plane. But after a little more experience with it I decided I preferred the two-control, non-spinnable airplane to the more conventional type of lightplane

On February 21 I embarked on the return trip from Sarasota to Chicago, with Danny as co-pilot. Our first day's hop began with a routine check of weather, checking the plane and other incidentals. We made Macon, Ga., the first night, watched a gala parade and enjoyed a comfortable night's rest. Leaving Macon airport at nine the next morning, we landed at Sky Harbor at six that evening—nine hours flat, including the necessary refueling stops.

An industrial insurance company executive, Mr. Cotter made the trip described here when he had but 34 solo hours. At present he has logged in excess of 300 hours flying time, and is still engaged in making cross-country lightplane trips.

Shortly afterward, in quick succession, I made my short, triangular cross-country flight and on March 17 took my private pilot's written examination. Two days later I learned that I had passed with flying colors and I then went aloft with a CAA inspector for the flight test. The next day my private ticket was safely tucked away in my wallet.

The very next morning I bravely embarked on my first real solo cross-country flight—back to Sarasota. It was during March when the weather is anything but favorable and I admit to some apprehension. After all, I wasn't in the "hot pilot" class and the trip was quite a long one for a neophyte like myself. However, I resolved to prove that a businessman, with the proper training, can use a lightplane to advantage just as readily as a younger pilot.

Leaving Chicago at 12:10 p.m. on March 21, I headed southward and at 5:30 p.m. landed at Memphis, Tenn. In St. Louis, my refueling stop, I quite leisurely had lunch, looked the airport over and made my departure—all in one hour.

After a cool night's rest in Memphis I departed from the attractive airport there at 8:10 the next morning. I made a refueling stop at Tuscaloosa, Ala., checked the weather and my maps, all of which consumed 30 minutes. At Dothan, Ala., I enjoyed lunch, inspected the field, checked my gas, oil, maps and a much-improved sense of confidence and made the take-off, all in 90 minutes. To kill time, I spent an additional hour and a

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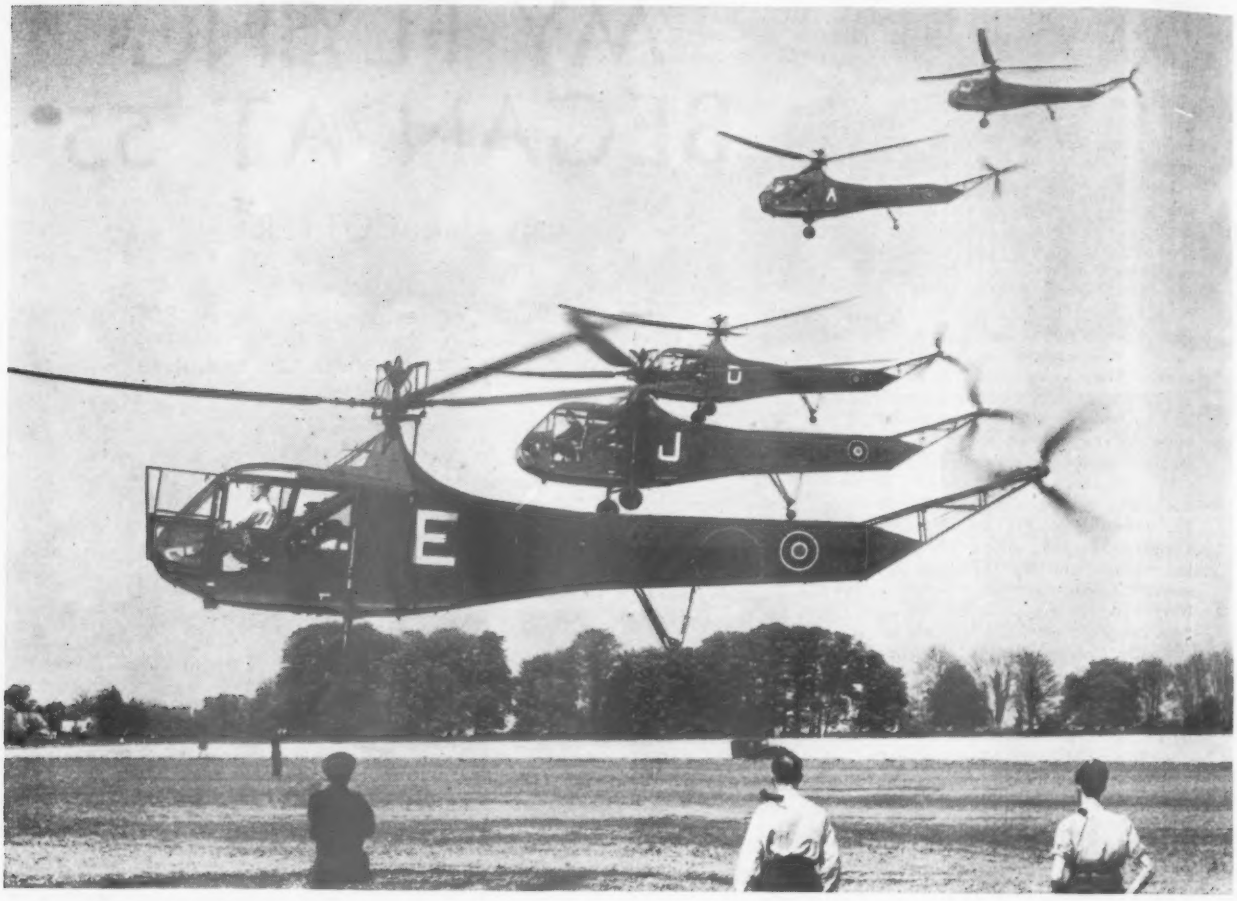


Sikorsky R-4B helicopters fly formation at an RAF school. This is very difficult close to ground because of gusts and air swirls.

THE HELICOPTER TODAY

By JAMES G. RAY
Vice-president, Southwest Airways Company

Helicopters have great future possibilities. But flying them still takes a lot of learning.

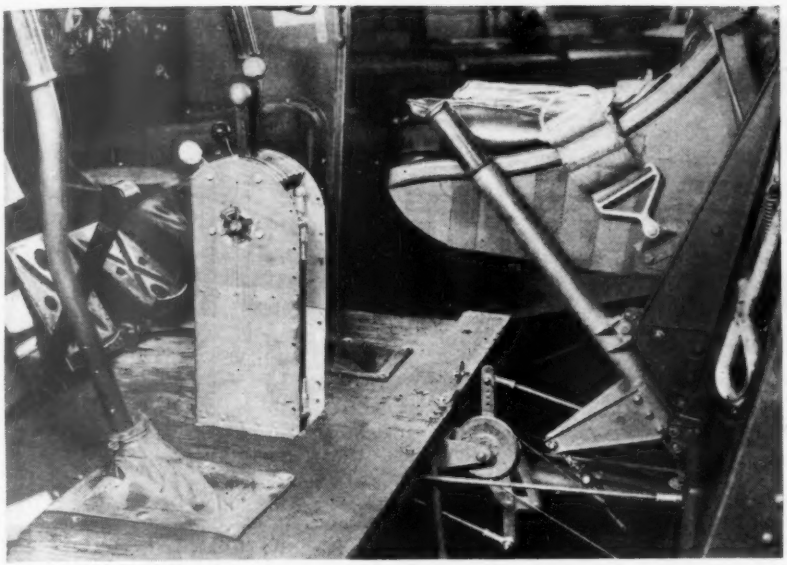
MAN has been flying a very short time —some 42 years in airplanes, a little longer in gliders and lighter-than-air vehicles. This new freedom of motion has been, to some extent, unnatural for him. Adding the third dimension to his sphere of locomotion has made it necessary for him to familiarize himself with a new relationship of movement when he navigates the air.

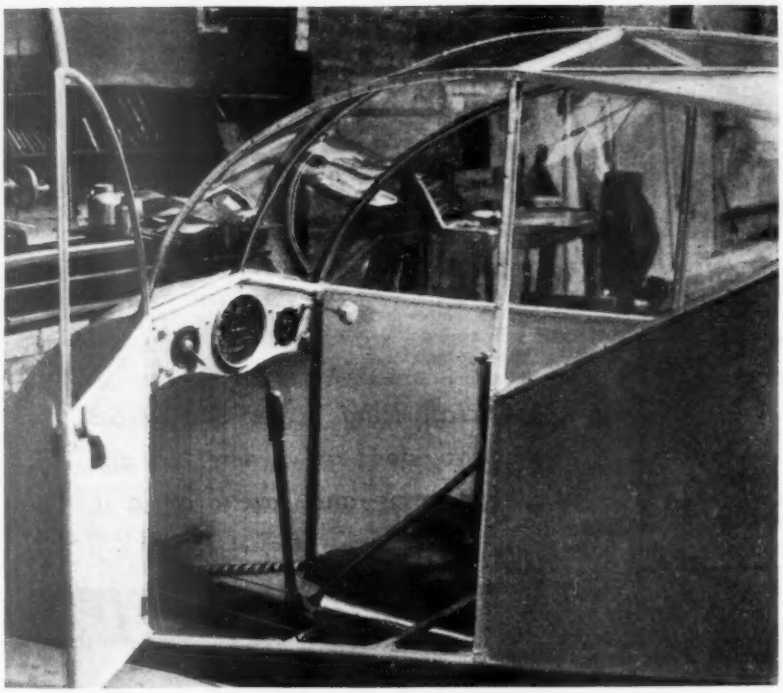
In nearly all of his locomotion, both in the air and on the surface of the earth, he has moved forward and in the direction of his heading. The few exceptions, such as the drift from tides and currents when on the water and from winds when flying, sometimes prove to be very confusing. But all of the vehicles man has built move ahead with, of course, a limited means for moving them backwards—all, that is, except the helicopter.

A rotor has no front, consequently it can move in any direction with equal facility. And it does. Its thrust is omnidirectional and is imparted to it by inclining its axis. Most helicopters have fuselages that are more streamlined when the air is flowing from a forward direction but this is only a limitation at high speed. At low speed they move in any direction, regardless of heading. And, of course, the third dimension is added, giving complete freedom of movement in every conceivable direction—the first time man has ever attained it. As a matter of fact, such complete freedom of movement does not occur in nature.

You often have heard the statement that helicopters are difficult to fly. Actually it is not difficult to make them do what you want them to do. Most helicopters respond quickly and positively to the controls. But it is difficult to cope with and to master this unaccustomed freedom of movement.

Greater piloting responsibilities are involved. It is necessary to know at all times your exact relation to your environs. If a change in this relationship is





Controls of Sikorsky helicopter (top) and the Hillercopter. Main helicopter control problem so far is to co-ordinate throttle and pitch stick. The author regards the latter as "one control too many" and believes that pitch change must be made automatic, with a throttle movement automatically inducing correct rotor pitch change.

occurring, you must know the amount of the relative motion and of any variation in it. Thus, a greater awareness is required in piloting a helicopter than for any other vehicle.

Of course, if helicopters are flown from good-sized airports and are not maneuvered in their slow flight range in the vicinity of obstacles, the greater piloting responsibilities are not present. But the helicopter will not be used so conservatively. Its special flight characteristics will be exploited in every way possible to attain greater utility.

With freedom to move in any direction, a helicopter pilot should be able to see in any direction—which, of course, is impossible. The pilot himself is not built that way. But it is very desirable to get as much vision as possible. Most helicopters now in use have excellent visibility with the areas that are blanked off by structure generally corresponding to the areas that are blanked off by the pilot's body.

It is the purpose and duty of the designer to make the pilot's job as easy as possible. With airplanes a great deal has been done to attain inherent stability. Hands-off flight stability is desirable in helicopters, too, when flying at high speeds. But in the low speed range it is of little value.

The reason this is so is that while maneuvering in the proximity of the ground and other obstacles—there is no need to maintain a status quo flight regime for any prolonged period of time. Nor can such flight regime be maintained by the inherent stability of the aircraft; too many external forces are acting upon it which will induce motion relative to the surrounding obstacles. The aircraft is being sustained in a medium that itself is unstable, thus a stable helicopter in hovering flight must be watched and controlled continuously anyway.

Of course there is no advantage in having the helicopter unstable. But a small amount of instability, the amount usually encountered in riding the air-pack, goes unnoticed because of the many other disturbances for which correction must be made.

For this kind of flying the thing that is really important is to have adequate control. The directional control is not of much value and is not critical. But of great importance is the ability to vary attitude.

Fortunately it is easy to attain perfect control of the attitude of the disc of a helicopter. A cyclic change of blade pitch will fly the disc to its new and corrected position without control lag. In fact, it is quite easy to get too much control force from a rotor. Rotary wing aircraft have been built with controls so powerful and so sensitive that they could not be flown.

However, the turbulence of the air will require considerable power in the helicopter's controls. Unlike an airplane that moves rapidly through gusts, the helicopter may be in the influence of a particular gust or swirl of air for some time. When flying in the immediate vicinity of obstacles, the disturbing effect must be overcome without permitting an appreciable movement of the aircraft. Often the disc must be moved instantly against the gust in order to counteract the gust's movement. It is easy to see the need for power and instantaneous response in a helicopter's control system.

A requirement of a good rotor control is that the speed of response to a given stick movement be the same in each direction. In most helicopters the longitudinal moment of inertia is considerably greater than the lateral, and a greater amount of pitch change must be provided to overcome this greater force. From the pilot's standpoint, the rate of change in disc attitude should be the same laterally or longitudinally for an equal movement of the control stick.

Unfortunately, the control of the variations in altitude of a helicopter is not so good. Nor is it so easy to obtain. The variation of lift is dependent upon the variation of power, and in the arrangements usually used—there is too much lag between the change of power and the

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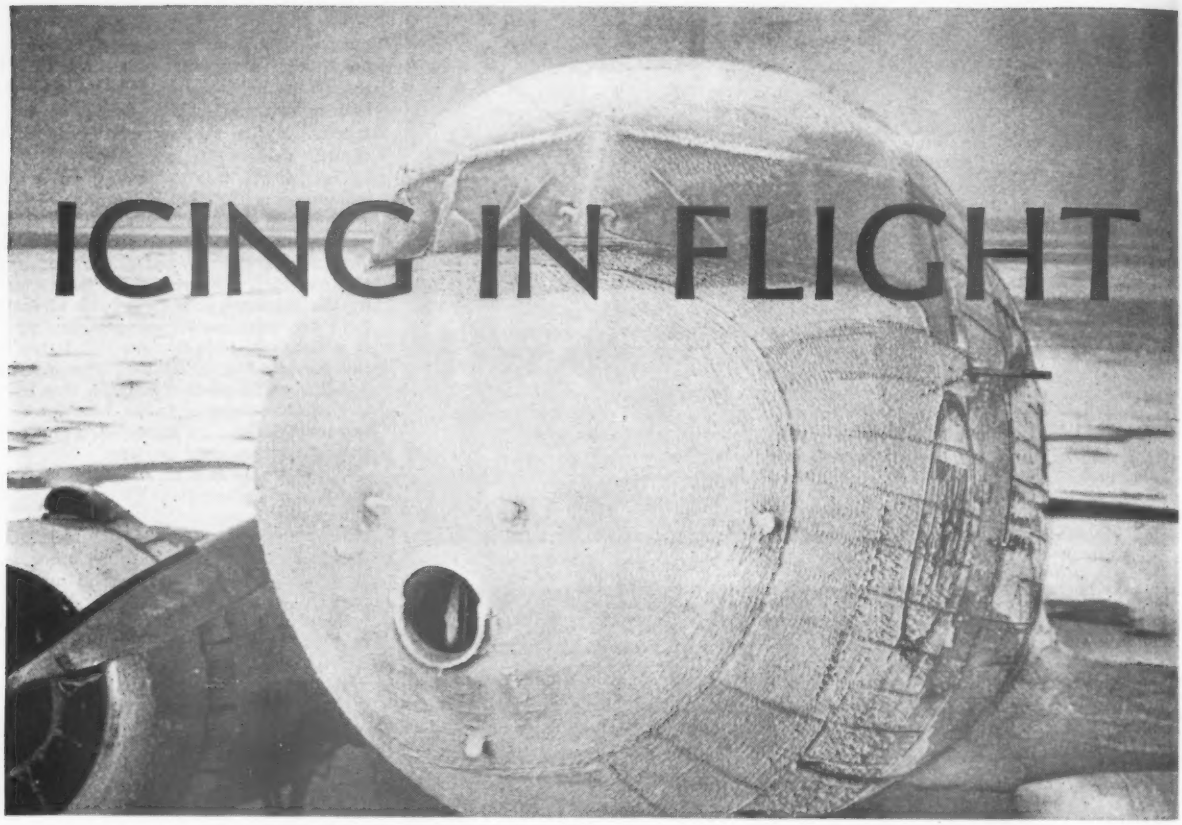
ICING IN FLIGHT



Heavy layer of rime ice coating this DC-3 may have been picked up in 15° to 25° temperature level where severe icing is found.

EDITOR'S NOTE

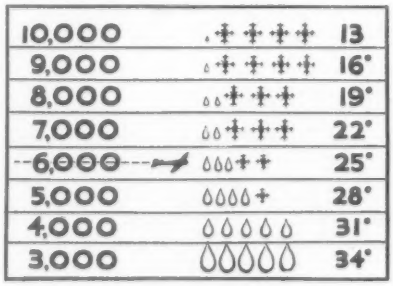
This is a condensation of the Navy booklet entitled "Ice Formation on Aircraft," prepared by the Training Division, Bureau of Aeronautics. It is one of the Navy's aerology series, reprinted here because of its simple, lucid presentation.

Aircraft icing is very dangerous when you don't know where, how and why it forms—and how to avoid it.

THERE are two kinds of ice, and if you ever looked inside a refrigerator you should be familiar with both of them. One is *rime* ice, the kind that forms on the refrigerator's coils. It is white, granular and breaks off easily. The other is *clear* ice, the kind that forms in the ice trays and can be broken loose only with difficulty.

Ice forms in the air only when two things happen simultaneously—when moisture is present in liquid form, and when the temperature is at freezing or below. All clouds contain liquid moisture, thus if temperatures are at freezing or below ice may form on an airplane just as on the cooling unit of a refrigerator.

Cloud particles in smooth air are drops of liquid water with a diameter of approximately .01 mm. The weight of a drop of this size is so slight that it sinks very slowly, pulled downward by gravity. If water drops are larger, a strong updraft of air is needed to keep them from falling to earth as they increase in size and weight. When a drop becomes too large to be supported by an upward movement of air, it falls to the ground as rain.

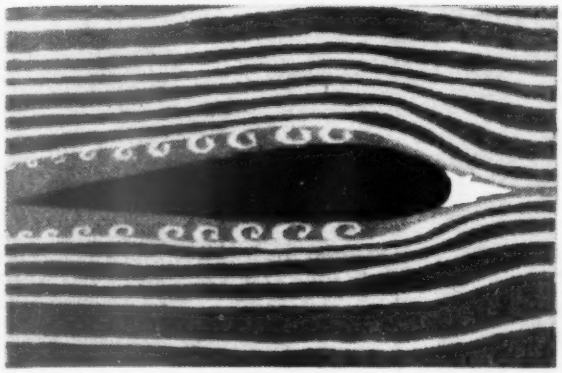


Altitude increase, temperature drop reduces size of water droplets. Ice particles form at higher altitudes.

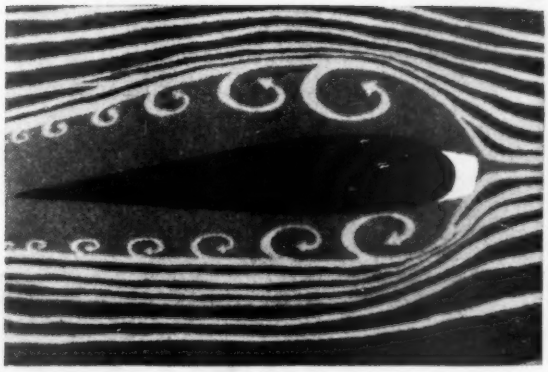
Turbulence, or bumpiness, shows the presence of vertical air currents and therefore there will be larger water drops in rough than in smooth air. When a *small* droplet strikes the leading edge of a wing or other exposed surface of a plane in freezing temperature, it freezes immediately and takes a granular or crystalline shape. This is *rime* ice.

A large drop will not freeze immediately upon impact but will splash or spread into a thin sheet of water which then freezes. This is *clear* ice, which forms more quickly and sticks more tightly than rime ice. It is easier to pick up, harder to get rid of, and therefore is a greater hazard to flying.

Rarely will you find an icing area in which only one type exists. Usually a combination of the two is encountered. But in the combination, the ice will be



Rime ice usually forms a sharp, protruding ridge on leading edge of wing which does not seriously disrupt airflow.



Clear ice adds a blunt, rounded addition to wing leading edge which seriously disturbs airflow necessary to lift.

more clear than rime, or more rime than clear, with the ice formation adopting the characteristics of the dominant type. If the formation is more clear than rime, watch for all the hazardous characteristics of clear ice. But if it is mostly rime it may have some qualities of clear ice which will make it more difficult to get rid of than if it were pure rime.

There is more liquid moisture in clouds at warm temperatures than at cold. Near the freezing point—the cloud is made up of large water drops; at lower temperatures the droplets become smaller and ice particles appear in increasing numbers. When the temperature is below 15° the clouds consist largely of ice particles. The danger to aircraft is not from ice particles because they will not adhere to the plane. It is the water droplets present which freeze on impact that spell danger. Axiomatically, a plane gathers more ice in a given time flying through regions where there are many large water droplets than where there are fewer small droplets.

It is characteristic of turbulence that it will lift water drops from lower levels up to heights where the cloud temperatures are less than 15°. In two clouds at the same sub-freezing temperature the turbulent cloud will produce clear ice and the non-turbulent cloud will produce rime. Thus a turbulent cloud, even at very low temperatures (zero degrees), may produce severe icing while a non-turbulent cloud at much higher temperatures (up to 32°) may produce only rime.

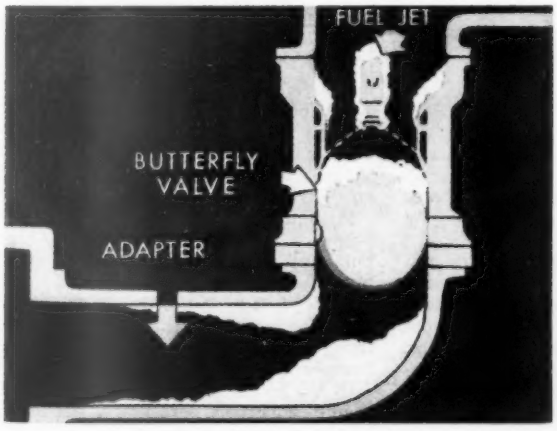
In general, the severest icing conditions are met in clouds near 25°. Both clear and rime ice are most severe there. The speed with which ice forms always diminishes as temperatures become colder. This extends the flying time before the icing becomes critical. Under some conditions ice forms slowly at temperatures well below zero. In the Arctic there have been cases of icing reported at —20°. On a long flight this is a hazard due to loss in speed and increased fuel consumption. On such flights, avoid icing clouds wherever practicable.

If you are flying in smooth air and get rime ice and the air becomes more turbulent, the chances are either that you are going to get clear ice or a more rapid formation of rime ice. If this happens, remember that the colder the temperature, the slower the ice formation. So either get underneath the clouds or go up where it is colder.

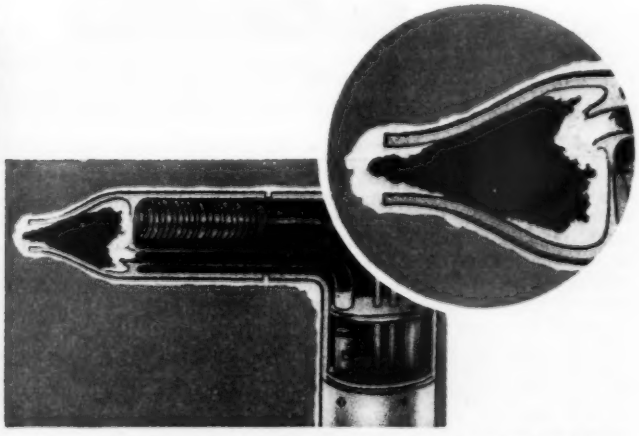
There are seven critical places on an airplane where ice may form that will affect its performance or even render it unfit for flight. (1) It may form on the leading edges of the wings, and tail assembly; (2) It may form on the propeller blades reducing or destroying their efficiency; (3) It may form within or on the pitot tube, giving you incorrect airspeed readings; (4) It may collect on a radio antenna and cause it to break, or may bridge over the insulators and ground the antenna to the plane structure, cutting off communications; (5) It may form in the carburetor causing loss of power or even complete engine failure; (6) It may cover your windshield to such an extent that you would have to break it out in order to have sufficient vision to effect a safe landing and (7) during freezing weather, a plane can become coated with ice, frost or wet snow when on the ground, seriously reducing the lift of the wing and causing the controls to stick.

Water, frost and snow must be carefully cleaned from a plane prior to take-off and controls checked to make sure they are free. In freezing temperatures when fog is present, ice may form on the propeller blades even during warm-up, causing an accident on take-off. Under these conditions, if your aircraft has a propeller de-icer, use it during the warm-up.

Seaplanes may become dangerously

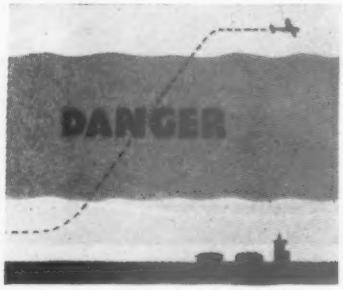


Effect of fuel evaporating in carburetor air stream can cause fuel ice to form, closing adapter passage, butterfly valve or the fuel jet. Prolonged fuel icing will cause engine failure.

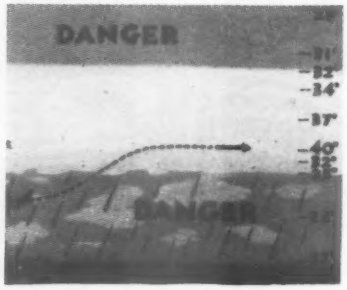


Impact ice, forming inside the pitot tube or on the pitot head itself, affects the airflow about the pitot opening and results in incorrect airspeed readings due to pressure in the tube being lessened.

Here Are Some Procedure Tips if You Run into Icing Conditions Aloft.

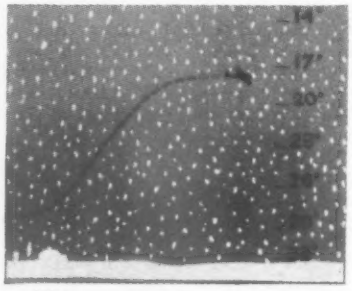


1 If ice is noted after takeoff, climb up through icing clouds as rapidly as possible to keep icing to minimum.

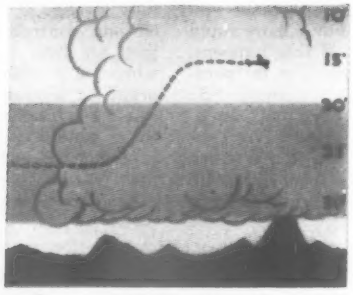


2 Freezing rain means clouds above are above freezing. Climb to level where the temperature is above 32 degrees.

3 Sleet means severe icing conditions are above you. Sleet is not too dangerous, so stay at your present level.



4 Wet snow aloft is a danger signal. Climb to a colder level where the snow will no longer be an icing problem.



5 Over mountainous areas, if you get clear ice, climb to 15° level, less-dangerous rime ice may form instead.

iced from *spray* while taxiing, although comparatively little ice forms during the actual take-off. Thus, a word of advice to seaplane pilots during weather and conditions favorable to ice is: make your takeoff with the least amount of taxiing.

Airfoils are carefully designed to permit a smooth flow of air over the top and bottom surfaces. Any change in this shape disrupts the flow of air and reduces the efficiency of the airfoil. Rime ice *usually* forms as a sharp protruding ridge and may not seriously affect the flow of air. Clear ice, however, forms a rounded, blunt addition to the leading edge which disturbs the flow of air to a greater degree and thereby reduces lift, sometimes to a point where the plane will not fly with normal load and full power.

The separation point of the airflow past a wing surface is some distance in advance of the leading edge. Small drops of water tend to be carried away from the wing by the air stream. Larger drops, due to their greater momentum, will resist this displacement and tend to strike the leading edge of the wing, forming clear ice.

Two forces operate on the wing of an airplane—lift, which tends to raise the plane, and drag which retards its forward progress. As ice forms in a blunt shape on the wing's leading edge the drag increases and the lift reduces. It is not the weight of the ice but its *shape* that does the harm. The blunter the ice formation the more serious its effect upon the plane's performance. Analogous is the sharp prow of a fast speedboat compared with the blunt bow of a barge.

The first indication of wing ice is a thin ribbon along the leading edge which gradually builds forward into the airstream and vertically toward the top and bottom surfaces of the wing. Initially, wing ice has no serious effect but as it grows toward the point of maximum camber the airflow is distorted and danger results. When it reaches these points it is even more hazardous than ice on the leading edge.

The first indication of ice forming on the tail assembly may be a tendency of the tail to swing, or possibly a vibration that, on some aircraft, may become heavy enough to cause structural failure. This is because ice forming on the tail surfaces disrupts the airflow, just as it does on the wings. In addition, if ice forms on the leading edge of the balance surface of the rudder, the rudder becomes overbalanced and develops a swinging tendency.

There are four ways to get rid of ice. They depend on the type and kind of aircraft and its equipment. These methods are by melting, by evaporating (in clear air), by breaking it loose mechanically (de-icer boots), by use of de-icing fluids (such as alcohol, or a solution of alcohol and glycerine), and by use of preheat. It can be evaporated by getting out of the cloud formation into clear air, preferably on top. It can be broken loose by proper use of expanding de-icer boots. It can be loosened or prevented with de-icing fluids on the propellers, and as a supplemental means of dealing with ice on the windscreen or windshield, as well as ice in the carburetor or on the pitot mast. It can be melted off by preheating devices. But since every icing condition presents a different problem only general statements can be made as to the best means of combating it.

Even a small amount of wing ice will increase the stall-speed of a plane. Bear this in mind particularly when landing. It may be desirable to resort to a power landing. Make no sharp turns or abrupt maneuvers near the ground if you have a load of ice. Make your final approach to land in a long, straight power glide with ample excess air speed above the normal stall-speed, and then fly the ship on the runway.

Maximum efficiency of the airplane propeller is vital to safe flight. As ice builds up on the blades the shape of the blade section changes and efficiency is reduced, just as in the case of the wings. Propeller icing can reach a point where flying speed no longer can be maintained because the blades lose their thrust.

Of the power developed by an aircraft engine, a certain percentage, depending on the efficiency of the propeller, is converted into thrust. As ice accumulates on the propeller more of this power goes into overcoming the increased drag of the

(Continued on page 93)

New twin-fuselage P-82 has a 475 m.p.h.-plus top speed and 3,000-mile range. Plane's ceiling is 45,000 feet. Pilot flies from left cockpit, co-pilot, gunner or radar operator occupying right side. Engines are 2,200-h.p. Rolls Royces.

TWIN MUSTANG

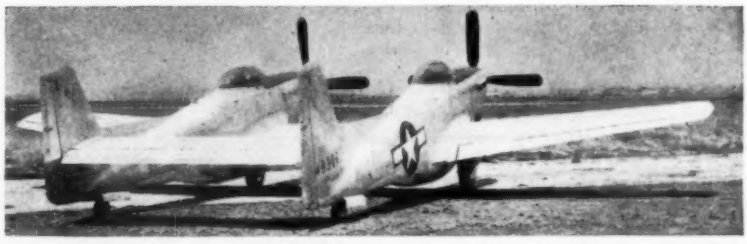
AT ONE stage of the air-war, both in Asia and Europe, there was urgent need for a long-range fighter that could be produced quickly. The airplane illustrated here is one result of that demand. It was thought that, with a minimum of engineering, two *Mustangs*—already in high-speed production—might be hooked together.

Known as the P-82, the *Twin Mustang* has shown itself to be good enough to warrant continued experiments. Powered with two 2,200-h.p. *Merlin* engines, the P-82 has a top speed of over 475 m.p.h., maximum range of over 3,000 miles and a ceiling of 45,000 feet. Wing span is 51 ft. 3 in., length, 38 ft. 3 in.; height, 13 ft. 8 in. Gross weight is 20,000 pounds; weight empty is 14,350 pounds.

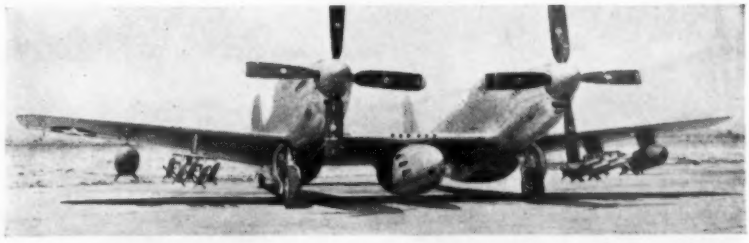
The two fuselages are practically complete airplanes in themselves. The plane's pilot flies in the left-hand cockpit; the other cockpit can be occupied by a co-pilot, radar operator or observer. The right-hand cockpit has detachable controls and a basic set of instruments. The landing gear is conventional, except that it includes two tail wheels.

Armament includes six .50-cal. guns in the center section, eight more in a detachable unit (see photograph), from 10 to 25 rockets, four 1,000-pound bombs.

Only 20 P-82's have been built to date.



Mustang characteristics remain similar in fuselage lines, canopy, square-tipped rudders. "Four-point" landings result from use of twin, retractable tail wheels.



What appears to be a drop-tank under center wing is actually an eight-gun nacelle which boosts P-82's firepower to 14 .50-cal. machine guns, 10 rockets, two bombs.

By Maj. OLIVER STEWART

British Authority, Editor of Aeronautics

DISCUSSIONS published in FLYING about the design of new personal aircraft and about the models now being produced in the United States, have been followed here in London (where FLYING is keenly read in the Royal Aero Club and elsewhere) with something like envy.

Everybody is thinking about private aircraft, drawing pictures of their ideal type on the tablecloth and wondering what the prices will be. But Britain's manufacturers have as yet few types to offer.

Most people look to the de Havilland company for light aircraft, for this company with its *Moth* series was one of the most successful in the field. But although the de Havilland *Dove* (a light transport) has been successfully test flown and is going through its trials well, no smaller machines have yet been planned.

The Miles *Messenger* is one of the few new designs—the Taylorcraft *Auster* was thoroughly developed for military purposes. The *Messenger* is a development of the M-28, a light training and communications aircraft. It is a three-or-four seater with a span of 36 ft. 2 in. and a top speed of something like 115 m.p.h.

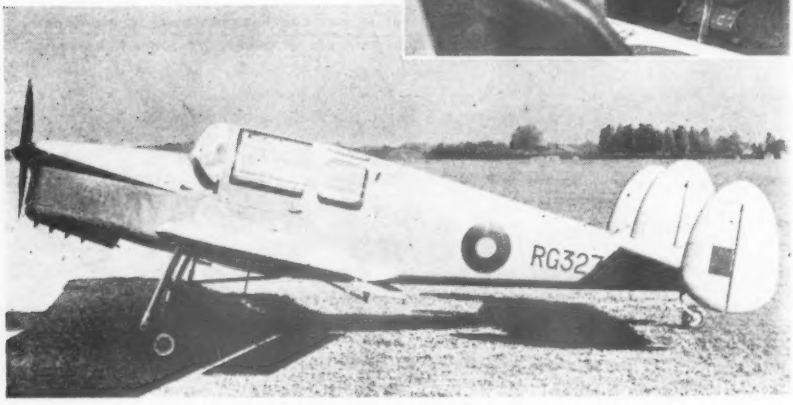
A low-wing, wooden monoplane with fixed undercarriage, the *Messenger* has triple fins and rudders but is otherwise fairly conventional in design. A fresh version, the M-48, is being prepared and will have retractable wing flaps.

The Dove

As it seats from eight to 11 passengers, the de Havilland *Dove* is chiefly concerned with feeder-line work rather than private ownership. But a few rich men might become owners of *Doves* in the future.

The first flights showed that the de Havilland company may again have laid the first stone in the building of peacetime prosperity. It is a very advanced little machine, with tricycle undercarriage, braking propellers and a great blown transparency over the flight deck which has obvious affinities with the canopies of single-seat fighter aircraft.

The engines are two de Havilland *Gypsy Queen 71s*, which are inverted, air-cooled, six-cylinder-in-line engines, geared and supercharged. Take-off power is 330 h.p. each at sea level. Cruising speed of the aircraft is 184 m.p.h. Maximum level speed is 218 m.p.h.



British Miles Messenger retains general lines of M-28 trainer, including wooden structure, fixed gear and triple fins (below). Plane is three or four place, has 115 m.p.h. top speed. Simple cockpit layout shown at right.

Propeller Braking

There has been some controversy in Britain about whether propeller braking, by reverse pitch, is practicable or necessary on small machines. The view of the propeller division of the de Havilland company strongly favors propeller braking for small machines as well as big ones.

Although an extremely high rate of pitch change is accepted as desirable for propeller braking, it is thought that effective braking can be had with a rate of change of 15° or 20° per second.

The piloting technique recommended is for the reverse pitch to be selected just before the touch-down and for the pilot to open up his engines fully the moment the wheels are on the ground. The claim is made that with really effective propeller braking the landing run can be brought down to one third of what it is with wheel brakes alone.

It seems that in the *Dove* the de Havilland people will prove their point as far as small feeder-line aircraft are concerned; but whether braking propellers would ever be likely to come in for yet smaller, personal machines is in doubt.

Tail-less

Another small aircraft about which some details were released during the month is the Handley Page *Manx*, a twin-engined, tail-less machine. It is not intended as a private-owner or feeder-line aircraft, but solely as an experimental machine for testing ideas Sir Frederick Handley Page is known to hold about the tail-less formula.

The *Manx* has two *Gypsy Major* engines of 140 h.p. each and the wing span is 40 feet. Cruising speed is 150 m.p.h. and ceiling 15,000 feet. It carries a pilot and one passenger and has an all-up weight of 4,000 pounds.

A good deal of work has been done with this machine upon control and stability with the tail-less formula. The wing tip controllers have not been entirely satisfactory and front rider planes may be tried to improve the control. There is a small fin at the rear end of the nacelle. So the *Manx* seems to be going the way of so many tail-less designs, and gradually turning to the conventional methods of obtaining stability and control.

Speed Record

Sporting flying has been so much in the background for so long that when it came out that Britain was to make an attempt on the world's speed record, few could recollect the conditions under which these records are made.

When the Fédération Aéronautique In-

(*Continued on page* 122)

U.S. TACTICAL AIR POWER IN EUROPE

Tactical air power played a vital part in winning the European war. In this historic report, FLYING brings you an official account of our air tactics, to supplement last month's report on air strategy.

THE AAF's TACTICS AND HOW THEY WORKED

This 24-page section is presented to FLYING*'s readers as a special feature of great historical value. The material here is reprinted from the Army Air Forces' hitherto-classified publication,* Impact, *and records the role of Allied tactical air power. The story of our strategic air power was presented in a similar section in* FLYING*'s December issue The last of these sections. dealing with the AAF's airpower against Japan will appear next month.*

ON THE morning of August 7, 1944, two weeks after the First American Army had broken out of the Normandy beachhead at St. Lo, the front was visited by a certain German General Warmilont, Hitler's personal representative. The Germans had been attacking savagely for days in an attempt to close the gap and cut off the American forces which had been pouring through to the south. Warmilont undoubtedly was dispatched to find out why this had not been done. The sentiments he brought with him from his Fuehrer unfortunately have not been recorded. But the blast he got back from Von Kluge, commanding the German armies, was:

"Whether the enemy can be stopped at this point is still questionable. His air superiority is terrific and smothers almost all our movements. At the same time, every movement of his is prepared and protected by his air force. Our losses in men and equipment are extraordinary. The morale of our troops has suffered heavily under murderous enemy fire, especially since our infantry units now consist only of haphazard groups. Behind the front, terrorists, feeling the end approaching, grow steadily bolder. The 84th Corps has reached a certain degree of disintegration . . . fresh troops must be brought in . . from somewhere . . ."

General Warmilont fled from his melancholy recitation. How he later prepared the bitter pill for consumption by his chief will never be known. But two things were certainly as clear to him as they were to the other German generals. The *Luftwaffe* was nowhere to be seen, having failed utterly in its greatest crisis. Without it, the mighty *Wehrmacht* was being dissected by an enemy ground force no greater than itself and with considerably less battle experience, but made irresistible by the addition of American tactical air power.

This scarcely resembled the situation of a scant four and a half years earlier. The Germans had started the struggle with all the advantages except three. Their political, economic, and sociological structure had been carefully shaped for war for a number of years. They had the best equipped and most efficient (if not the largest) army, by far the largest and most powerful air force in the world. They were surrounded by smaller, weaker, badly prepared neighbors. Of the great powers which might possibly constitute a threat to them, one, Russia, was an enigma whose military ability and industrial efficiency was open to question; the second, Britain, was involved in trying to hold together a sprawling empire by political rather than by military persuasion and had no army or air force worthy of mention (her fleet was powerful, but Germany intended to fight this war on land and considered herself impervious to blockade); the third, the United States, was thousands of miles away and woefully unprepared.

Of her three disadvantages, Germany was aware of one. She was smaller than some of her potential enemies but she depended on her speed of conquest to enlarge both her manpower and her resources to a point where she could safely ignore this handicap. Moreover, she leaned heavily on what she thought was her superior air force.

The second disadvantage, and one she was unaware of, was the lack of anything to contend successfully with two British items, the new *Spitfire* and, more important, radar. German intelligence didn't know about radar and couldn't get the full story on the *Spit*. Britain had come to the correct conclusion that she could not be invaded as long as she controlled the air above her. Hence, the *Spit:* heavily armed and swift, designed exclusively for the destruction of other planes in the air, made enormously efficient by radar. Against German aircraft that had insufficient armor and armanent, the result was massacre. The German failure against the *Spitfire*-radar combination may well have cost Germany the war. It certainly for a long time ended her offensive ability in the west.

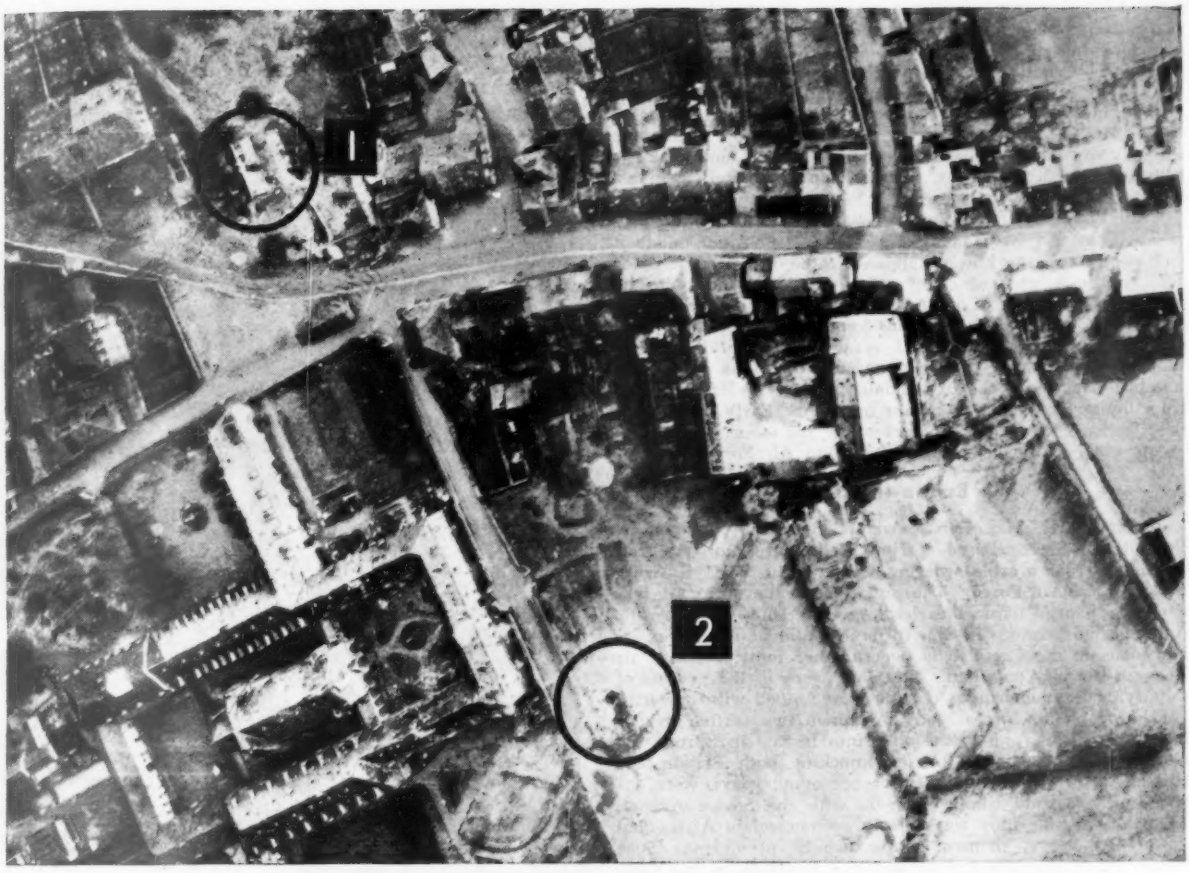
The third disadvantage was rooted in her concept of how the war would be fought and was, in essence, an insufficiency in the realm of ideas. Her air force was (and its remains still are) purely tactical. Her air planners did not discern the huge dividends that can accrue from a carefully planned strategic bomber offensive against the key industries that support ground armies.

After the Battle of Britain, it was apparent that, given time, Germany could be expected to reshape her air force and return to the attack. It therefore was clear that the war was only to be won for our side by wrecking German war industry with air blows and by invading the continent and defeating the German armies in the field. But Britain was small and the resources of her empire were at the ends of the earth, separated from England by the U-boat fleet.

It is against this background that the importance of America emerges. We were distant enough to be unmolested by bombing, and had the industrial capacity to make an enormous amount of anything we chose. With these assets, it was logical to assume that if our theories were valid and if we made the right sort of things to support our theories we could carry the battle to the enemy. Thus the burden of "winning" the war was in a sense put on America's shoulders. Inasmuch as the airplane had already proved itself the dominant weapon in modern war, the importance of clear thinking and good planning by the U. S. Air Corps was only too clear.

At this juncture, the leaders of the Army Air Corps well realized the principal tasks of military aviation used tactically: (1) the gaining of air superiority, (2) isolating the battlefield, (3) co-operation with the ground forces in offensive operations If, before 1939, the terrific power of tactical aviation had not been appreciated, the Germans corrected this. Their air force gave, in Poland, the Low Countries and France, a shockingly clear lesson on the effectiveness of the airplane as an air-ground weapon.

Our present doctrine on the employment of tactical air power did not evolve overnight. While we clearly understood what had to be done, we did not learn how to do it until we had been through the African campaign where the doctrine was forged that you can read in FM 10-20 today. This doctrine postulates a single commander under whom equal subordinate commanders of air and ground work together at a combined air-ground headquarters. Such an arrangement, first developed by Air Marshal Sir Arthur Coningham and General Montgomery, guarantees (1) joint planning wherein



The 3rd Army was scheduled to jump off in the Metz sector on November 8, 1944. So on that very day the 405th Fighter Group, 19th TAC, struck at the headquarters of the 17th SS Panzer Grenadier Division in Peltre. For results, see the lower photos.

1 This is Figure 1 on photo above, the G-2 section. Except for a few switchboard operators, the division staff was completely wiped out and all its records were destroyed.

2 This is the division officer's mess. The Nazi division was so badly disorganized that it could not act as a unit for two weeks, though it was intended as a mobile reserve.

ground plans are made utilizing air to maximum effectiveness: (2) efficiency: the air commander, who understands what air can do, is not in a position of being ordered to do the "impossible" by those unfamiliar with the capabilities of air and (3) flexibility: instead of being parceled out and "frozen" to various ground units, air can be utilized for strong punches where most needed. Also from the African experience came the splitting of air forces into separate tactical and strategic air forces with the latter, through top command, available for tactical tasks when needed.

While German tactical aviation was a mean customer, particularly in the early days when lack of opposition made it look good no matter how it happened to be organized, it never rose to the heights of effectiveness exhibited today in the combined operations of our tactical air commands and ground armies in Europe. The Germans kept their tactical air units shackled under the command of ground generals and in numerous other ways did not measure up to us. One outstanding example is the tremendous potency we have derived from fighters by hanging bombs on them. Early in the war the Germans used their fighters solely for escort.

And now, to the beginnings of the 9th Air Force.

We Began in Africa

In June, 1942, Maj. Gen. Lewis H. Brereton, commanding the 10th U. S. Air Force at New Delhi, interrupted a staff meeting to read a cable ordering activation of the U. S. Army Middle East Air Force. The situation of the Allies at that moment, theories or no theories, was little short of desperate. America had been in the war for six months and had seen all her bases in the Far Pacific overrun, her puny overseas air strength literally engulfed. The Japs were in the process of solidifying their enormous conquests and stood with powerful land, sea and air forces ready to launch two further drives, one at Australia, one to the west into India. In Europe the Germans, having barely missed knocking both Britain and Russia out of the war in the two preceding years, were engaged in a second titanic struggle with the Soviet Armies. At the same time they were firmly entrenched in Africa and threatened at any moment to capture Egypt and the Suez Canal. This would have flanked the Russians in the Caucasus. Worse, it would have unraveled the British Empire at its most vital seam and would have added immeasurably to the peril of India and Australia.

It was decided, therefore, to reinforce the British strength in Egypt rather than make further efforts to prop up its crumbling bastions in the jungles of India and Burma. Accordingly, Brereton proceeded to Cairo with a single squadron of *Fortresses*, which in those early, cockeyed days had been making its way east to bomb Tokyo, and the 9th Air Force was born. America's organized participation in the European tactical air war had begun.

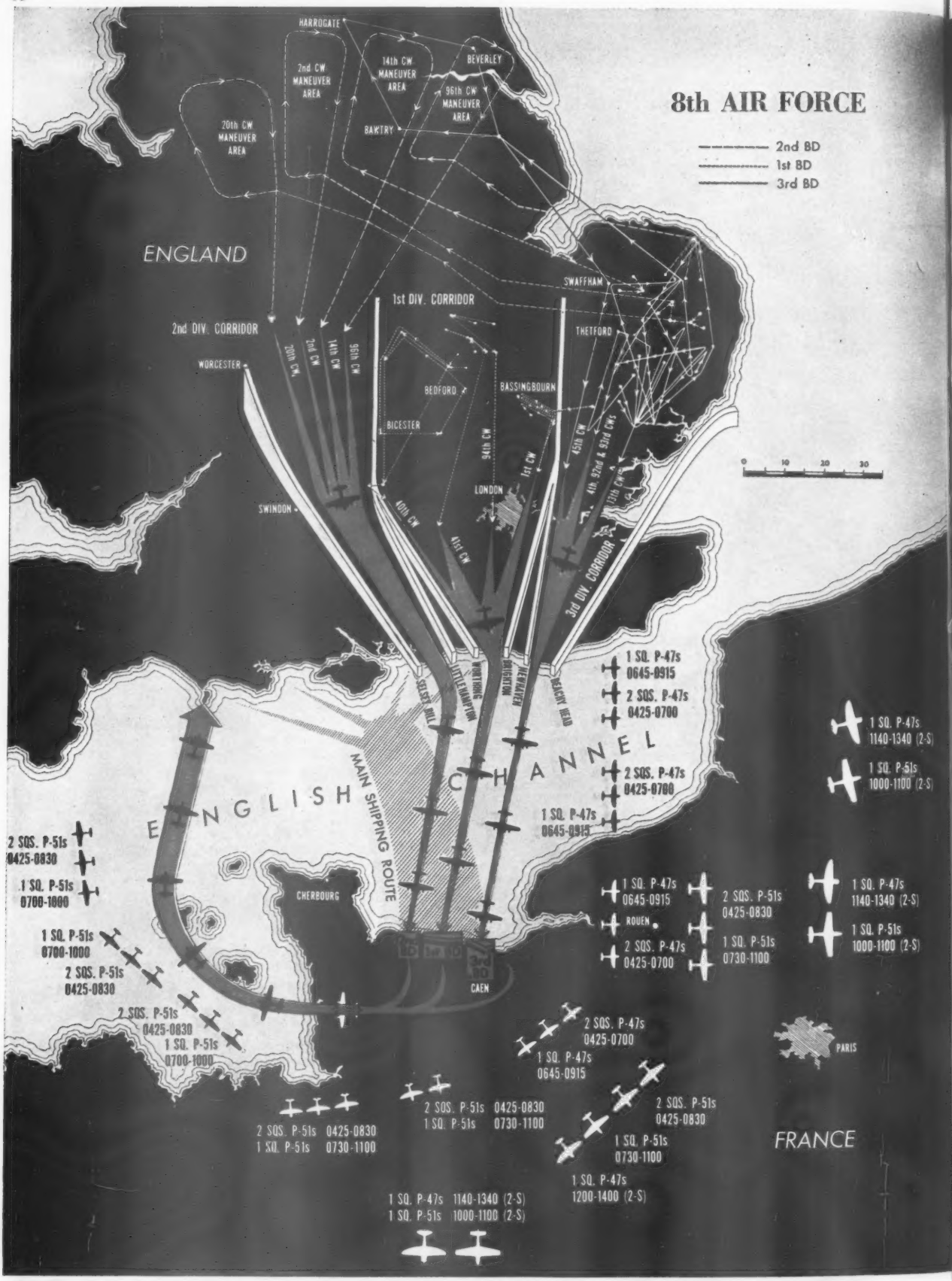
A better proving ground for a tactical air force than North Africa could not have been found. It had all the elements, on a small scale, of the greater battles we would have to fight later. We could profit cheaply by our own mistakes and by the example of the British, who already had two years' experience under their belts.

The first thing learned was the validity of what was to become the opening sentence of FM 100-20, which states: *"Land power and air power are co-equal and interdependent forces, neither is an auxiliary of the other."* Air and ground commanders met each day and between them worked out the best methods of employing their combined forces. They had constantly before them the sorry spectacle of the Italian Air Force, whose direction had been left to earth-bound generals and whose strength was consequently frittered away in one meaningless little operation after another.

Supply and maintenance problems had to be conquered. Sand and its end-product, dust, were the common enemy of all combatants. It coarsened food, thickened water, scored engine and gun alike. A multitude of unforeseeable little things had to be learned. Multiplied over and over again they, in the long run, enormously increased the effectiveness of the 9th, whose quick-learning ground crews kept a high percentage of aircraft operational at all times. The words of an anonymous squadron line chief illustrate the nature of these small but important details:

"To protect the pitot static tube from dust, we slip on an

Smoke and flames rise from the Baumsef marshaling yards near Leipzig, victim of one of the last 9th Air Force fighter-bombings of European war.


8th AIR FORCE
2nd BD
1st BD
3rd BD
ENGLAND
HARROGATE
2nd CW MANEUVER AREA
14th CW MANEUVER AREA
BEVERLEY
96th CW MANEUVER AREA
20th CW MANEUVER AREA
BAKTRY
SWAFFHAM
1st DIV. CORRIDOR
2nd DIV. CORRIDOR
THETFORD
WORCESTER
20th CW
2nd CW
14th CW
96th CW
BEDFORD
BASSINGBOURN
BICESTER
94th CW
1st CW
45th CW
4th 93rd & 93rd CWs
13th CW
LONDON
SWINDON
40th CW
41st CW
3rd DIV. CORRIDOR
0 10 20 30
SELSEY BILL
LITTLEHAMPTON
WORTHING
BRIGHTON
BEACHY HEAD
1 SQ. P-47s 0645-0915
2 SQS. P-47s 0425-0700
2 SQS. P-47s 0425-0700
1 SQ. P-47s 0645-0915
1 SQ. P-47s 1140-1340 (2-S)
1 SQ. P-51s 1000-1100 (2-S)
ENGLISH CHANNEL
MAIN SHIPPING ROUTE
2 SQS. P-51s 0425-0830
1 SQ. P-51s 0700-1000
CHERBOURG
1 SQ. P-51s 0700-1000
2 SQS. P-51s 0425-0830
2 SQS. P-51s 0425-0830
1 SQ. P-51s 0700-1000
1 SQ. P-47s 0645-0915
ROUEN
2 SQS. P-47s 0425-0700
2 SQS. P-51s 0425-0830
1 SQ. P-51s 0730-1100
1 SQ. P-47s 1140-1340 (2-S)
1 SQ. P-51s 1000-1100 (2-S)
CAEN
2 SQS. P-47s 0425-0700
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PARIS
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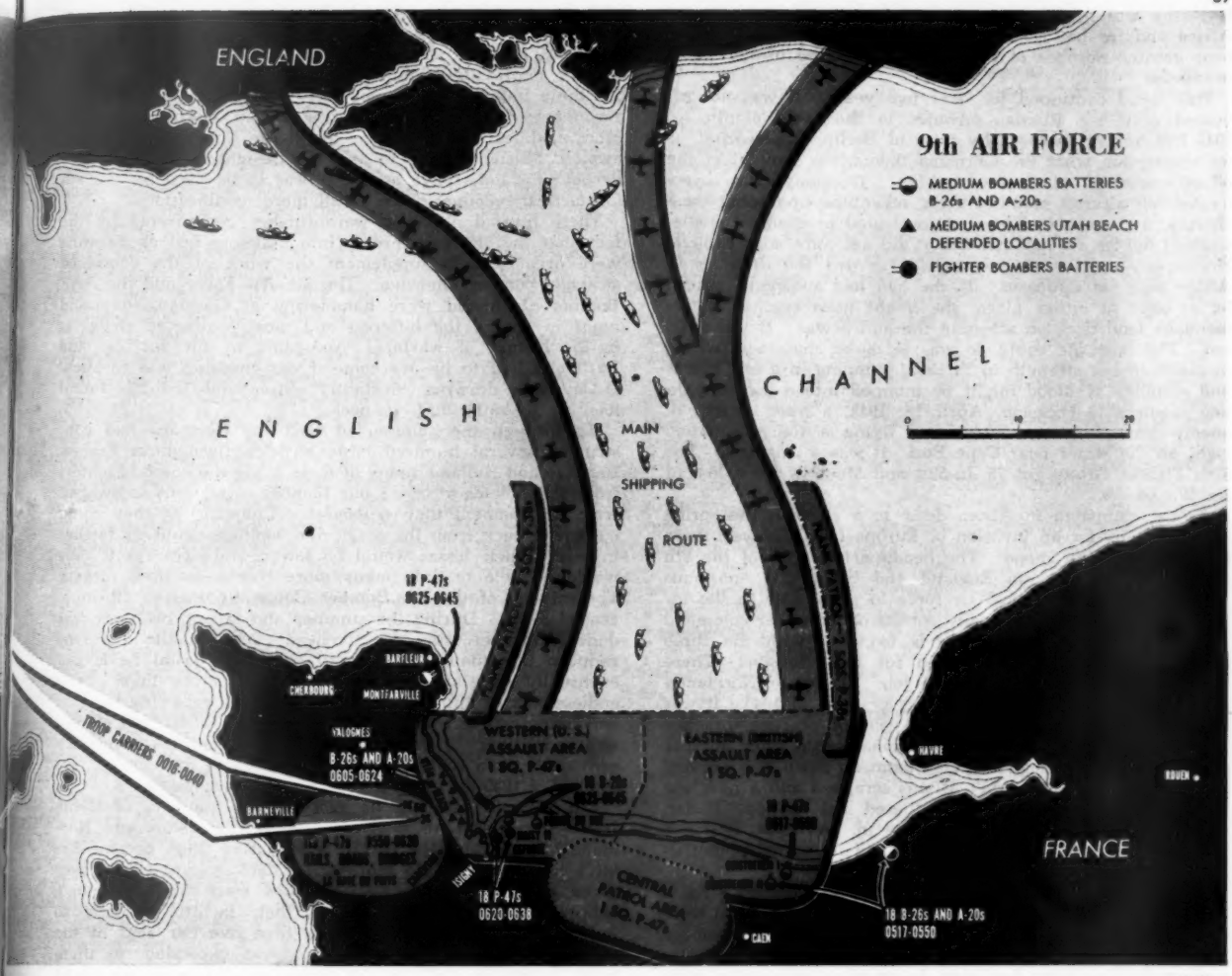
1 SQ. P-51s 1000-1100 (2-S)
FRANCE



These two charts show operations of the 8th and 9th air forces in the Normandy invasion. At left, 8th AF assembly alone assumes enormous proportions. Because of identification problems, 8th escorts stayed out of assault areas where TAC fighters operated.

old G.I. sock. At night we cover up the canopies with old mattress covers. If we didn't, the glass would reflect in the moonlight. The white stars on the wing tips can also be seen from the air on moonlight nights. When we run short of canvas I see to it that those wing tips are covered with extra blankets or empty barracks bags. The shell extractor chutes for the wing guns have small openings which would permit sand to enter and jam the guns if we didn't cover them. So we paste paper over the openings. With a razor we cut little slits. Then, when the guns are shooting, the fired shells can easily force themselves out of the way."

Other things also were learned: the necessity for close formations, the necessity for fighter escort, the peculiarities of German planes and their weaknesses, the need for some method of blind bombing, the importance of constant photo coverage, and how to keep up with a front that was moving like an express train. Our aircraft were modified again and again. We hung bombs on our *Warhawks*, thus taking the first step in a fighter-bomber technique which in two years was to give us an overpowering advantage in Europe.

The mission of the 9th in Africa was simple: Eliminate the enemy air force and at the same time work with the British 8th Army. But the execution was difficult. The 9th was still tiny. Its original *Fortresses* had been strengthened by a squadron of *Liberators* which already had begun limited operations in the Middle East. While these gained operational experience with strikes at ships and port facilities in Greece and Crete, the wheels at home were beginning to turn and the first trickle of an ever-increasing stream of aircraft began to emerge. Soon two *Warhawk* groups and a *Mitchell* group arrived. On October 23, when the Battle of El Alamein started, Brereton had 164 aircraft. The British had 1,117. Opposed to them were about 1,000 German and 1,000 Italian planes of all combat types. The destruction of this enemy force was undertaken forthwith. The North African ports were hammered remorselessly. Tobruk and Bengasi became so clogged with the hulks of enemy supply ships that they could no longer be used. Warehouses were smashed, convoys sunk. The enemy's supply lines became further and further strained until a captured German officer was prompted to repeat sardonically a war cry currently attributed to Rommel: "*Auf zum Angriff! Spirit ist da!* (Forward to the attack! Gasoline has arrived!)"

At the same time the mediums plastered the German airfields with fragmentation bombs and the fighters took their steady toll in the air. By January, 1943, Rommel had lost 700 planes. Of particular interest was the fact that many of these were captured intact by the ground forces, unable to escape because their tanks were dry. The value of the plane as an interdictor of battlefields was becoming apparent.

We continued to grow. A larger American air force, the 12th, was moving in from the west and hastening the collapse of the Axis in Africa. The Germans were not able to match that growth, nor could they replace their aircraft losses as they would have liked. The battle for the elimination of the *Luftwaffe* had spread as the 8th Air Force and the RAF in England set their sights on aircraft production and other strategic facilities in western Europe. To combat this menace,

Germany was forced to shave her aircraft requirements for Africa and for her assault on Stalingrad, and to commit an ever greater number of planes to the defense of her home industries.

This trend continued for over two years. It was not reversed until the Russian advance in the early months of 1945 had almost reached the gates of Berlin, emphasizing, as no words can, what the Germans themselves thought of the effectiveness of strategic bombing. Germany also overhauled her aircraft manufacturing schedules, upgrading them sharply, and embarked on a concentrated program of single-engined fighter production. But it did not come soon enough. Her involvement at home merely speeded the debacles in Africa and the Caucasus. If she had had sufficient aircraft or supplies at either place, she might have reached a tremendous land decision affecting the entire war. But she did not. The best she could do was to make spasmodic efforts to maintain her strength in Tunisia, pumping in a few planes and supplies as blood might be pumped into a corpse. On one memorable occasion, April 18, 1943, a huge swarm of enemy transports was intercepted flying a tight formation right on the water near Cape Bon. It was a massacre. The 57th Fighter Group got 75 Ju-52's and Me-323's for a loss of six *Warhawks*.

As the campaign in Africa drew to a close in the spring of 1943, plans for an invasion of Europe from the west were beginning to take shape. The headquarters staff of the 9th Air Force was sent to England and began the enormous task of building a tactical air force to participate in the invasion. This would eventually consist of a bomber command and three tactical air commands to work with the three American armies being gathered for the offensive. There was less than a year to do the job. D-Day in Normandy had been set for some time in May or June of 1944. It was a year of feverish preparation, a year of practice, practice and more practice. One organizational setup after another was tried, from the Headquarters Command down. If it worked, it became SOP. If it didn't, it was scrapped and a new one put in. Personnel had to be gathered and trained. Radar, as an offensive weapon, was coming in. As such, it was a brand new device, little understood and its varied potentialities unexplored. These had to be learned.

Above all, suitable aircraft had to be obtained. As a starter the *Marauders* of the 8th Air Support Command were turned over to the 9th to form the nucleus of a tactical bomber force, along with a few *Thunderbolts* as an infant fighter command. The latter had been designed as long-range, high-altitude escort planes. The problems of learning how to use them for dive bombing, glide bombing, toss bombing and skip bombing, also for strafing at minimum altitudes, the problem of improving visibility and otherwise modifying them for these unfamiliar tasks had to be thrashed out. A photo reconnaissance force of *Lightnings* had to be developed. More modifications were necessary here. Eventually the long-awaited *Mustang* began to appear. Designed, like the *Thunderbolt*, for long-range escort, it was to be used by the 9th for tactical reconnaissance. Still more modifications.

These myriad obstacles were further complicated by the fact that the 9th was thrown into battle as fast as its units were organized, to supplement the work of the combined strategic bomber offensive. The 8th Air Force and the RAF Bomber Command were hammering at Germany day and night in one of the bitterest and most protracted struggles in the history of warfare. According to our doctrine, the *Luftwaffe* had to be overcome if our invasion was to stick. D-Day was drawing constantly closer and the 9th found itself in the battle up to its neck.

Up through the summer of 1943 the Germans had constructed several hundred large airfields throughout France, Belgium and Holland, many of them along the coast. Fighters from these fields attacked our bomber formations in swarms from the moment they crossed the Channel. If they could be driven back from the coast, our bombers could fly farther in safety, their losses would be fewer, and as a result they would be able to drop many more bombs on their targets. The mission of the 9th Bomber Command was to hit these coastal fields. During the summer and fall of 1943 this was done with increasing effectiveness. At first the Germans reduced the number of aircraft on their coastal fields but eventually gave up entirely trying to operate them. The endless task of filling up cratered runways, repairing hangars and living quarters, and the mounting piles of twisted planes, wrecked either by frags or by strafing fighters, evidently convinced them that the game wasn't worth the candle. By the end of 1943 the air over the Channel coast was ours.

But the 9th received no rest. Great numbers of flying bomb sites began to mushroom along the Calais and Normandy coasts, and the task of eliminating them became the 9th's top priority. No more unsatisfactory target was ever given any bomber force. The sites were well concealed, simply and sturdily constructed, their facilities usually so located as to comprise not more than five per cent of the target area. An enormous effort was expended on them from December, 1943, to the spring of 1944, with the result

Illustrating the ruggedness of U.S. tactical aircraft, this Thunderbolt came in with a hung 500-pound bomb which rolled free on landing and exploded underneath the plane. Though destroyed, the plane was sturdy enough to protect pilot, who survived.

that the Germans abandoned their plans for launching the bombs in huge numbers from "ski-sites" and were driven to the construction of "modified" and portable sites. When the V-blitz finally started from these substitutes, the scale was too small to affect the course of the war.

The 9th Bomber Command was now full-grown and fully trained. The 9th Fighter Command needed but one more metamorphosis to prepare it completely for the second battle of France. It shut its eyes, gritted its teeth and gave birth to a huge and powerful baby, the 9th Tactical Air Command, consisting of an entire operating headquarters and all the planes of its mother command. It was organized to work directly with the First U. S. Army (the American invasion force) according to the pattern so carefully worked out in Africa. Soon another TAC, the 19th, was spawned, destined for co-operation with the Third U. S. Army.

The stage was now set for the greatest amphibious assault ever undertaken by man. The problem was the familiar one of any such operation: to pour men and equipment ashore at one or more points so fast that they could overwhelm the enemy defenses there, then dig in firmly to avoid being thrown back into the sea by the first enemy counterattack. From then on it would be necessary to siphon men and equipment into the beachhead faster than they could be brought up from the interior by the enemy. In this way only would we be able to build up sufficient local superiority to break out of our beachhead and engage our foes in a war of movement.

The Rail and Airfield Attacks

In the light of these requirements, the anti-rail and anti-airfield stage of our campaign appeared logical. In a few months of concentrated blows at these targets we hoped to eliminate the *Luftwaffe* entirely from the battle area and so to wreck the transportation system that troops could not be moved in fast enough to oppose our build-up. The task was a colossal one. There were a couple of hundred airfields to be hit, each one a difficult target to knock out. Once hangars and repair facilities are destroyed (and our own air forces in the Pacific have demonstrated that you can operate without these if you have to), all you can do is to put holes in runways and damage aircraft by strafing or with frags. With respect to the former, it is hard to stay ahead of the enemy, who can fill in the holes almost as fast as you make them. The latter becomes more difficult as the number of enemy planes decreases and as they are more widely dispersed and more carefully hidden. The rail problem was even greater.

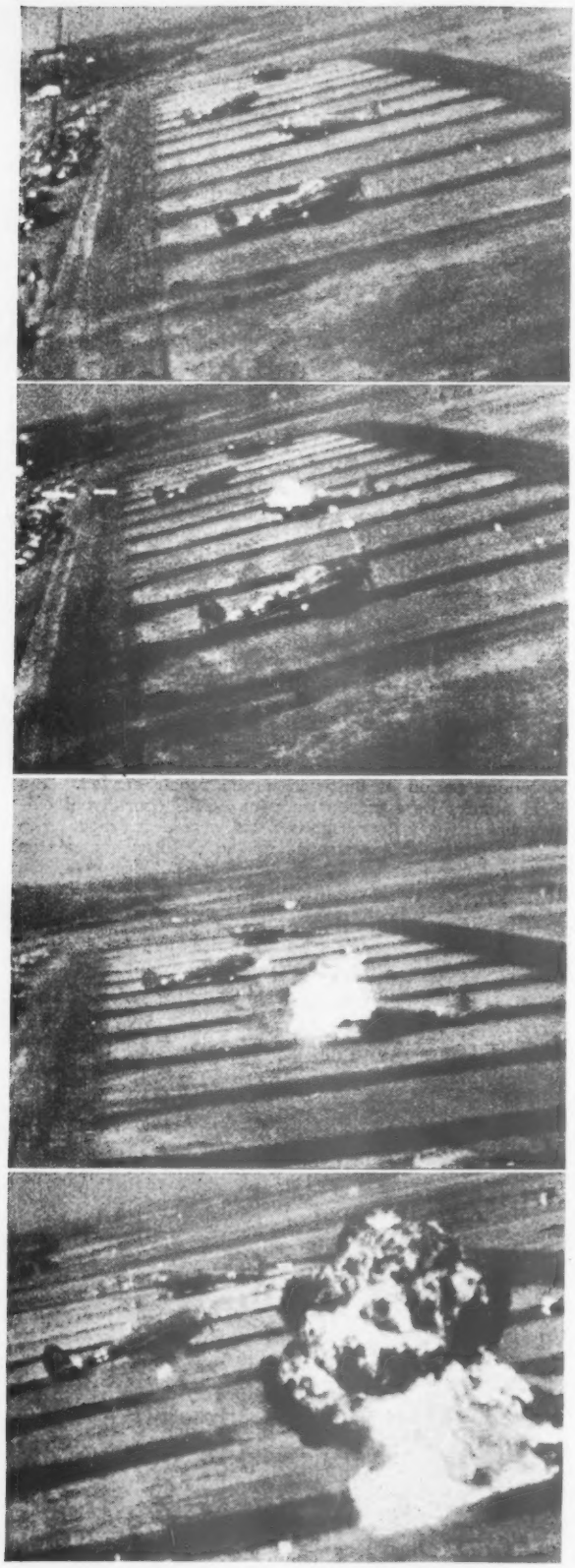
Northwestern Europe has a more complete network of double rail track than any other part of the world:

	Railroad miles per hundred square miles	Percentage of double track
France	12.6	47.2
Belgium	27.5	58.3
Holland	15.3	50.8
Germany	20.8	35.3
United States	8.3	11.9

Railroads in peace or war are accustomed to dealing with wrecks and washouts. Germany had augmented the regular emergency crews with extra workmen standing by in all important yards, and had placed large stocks of extra rails, switches and ties alongside the tracks. Experience in early attacks indicated that a rail yard could be completely blocked with a well-placed load of 500 tons, but only for a day or so. By then a through line would be in operation, with others following, depending on how badly they were needed. Prior to the invasion, Germany was only using about 30 per cent of the system's capacity for military purposes, the rest being taken up by industrial and civil traffic. Thus, capacity would have to be reduced by 70 per cent before military requirements were affected other than locally, for it was reasonable to assume that French peasants would not do much traveling nor French industry much shipping if the space were needed by German troops. Finally, we could count on considerable incidental destruction of locomotives and cars, but Germany was well supplied with both, having systematically collected the rolling stock of almost every country she conquered in Europe. Also the shortening of her communications lines as the result of Russian advances had eased her rolling stock position considerably. An added problem was the necessity for distributing our blows in such a way as not to betray where we planned to attack.

Despite these obstacles, the program was laid on and a monotonous period of destruction and repair ensued. The airfield attacks were most successful. GAF operational efficiency was cut way down, many fields were abandoned. The toll of enemy aircraft destroyed during the first six months of 1944 reached the staggering total of 6,053. These attacks supplemented the strategic campaign against the German aircraft industry and there is no question but that our overall counter-air force operation was the decisive factor in the *Luftwaffe's* failure to oppose the invasion. However, it is probable that the enormous numbers of Allied fighters in the air at all times and the feeling that the weakened GAF

Low-flying photo-Lightnings made hazardous dicing runs along the French coast before invasion in order to record shore and beach defenses. Every type of anti-landing obstacle appears above, including stakes, timber ramps, mines, steel obstructions.



Ground-strafing attacks upon the Luftwaffe produced outstanding results. Here a gun camera shows picture sequence of successful attack by 8th AF fighter plane on Luftwaffe airfield.

should be conserved for later crises also played their part. The complete answer will not be known until the GAF records are studied in greater detail. At any rate the result was as ordered:

Date	GAF fighter sorties	Sorties developed into ground attacks
D-Day	70	?
D plus 1	300	60-70
D plus 2	525-550	75-100
D plus 3	500	110-120
D plus 4	260-270	60-70

Results of the rail yard campaign are difficult to assess. As expected, yards were repaired almost as fast as they were bombed, and no insuperable difficulties were encountered by the Germans until after the invasion had started, by which time a specific rail interdiction program (to be discussed shortly) was under way that resulted in enemy troops having fantastic troubles in reaching the battle area. However, a general lessening of efficiency was achieved without indicating just where we would land. And as D-Day came closer, and as our rail effort became more and more concentrated, it became harder and harder for the Germans to keep up. The cost to us in effort was immense, justified only by the belief that anything, no matter how expensive, would be worth doing if it helped the initial landing.

D-Day Air Plan

On April 15, 1944, the plan for the invasion which set forth the part all Britain-based aircraft would play was formally issued by Headquarters, Allied Expeditionary Air Forces. It called for maximum effort by the RAF Bomber and Fighter Commands, the RAF Coastal Command, the Air Defense of Great Britain, two American and one British airborne divisions, the 8th Bomber and Fighter Commands, the 9th Bomber Command and the 9th and 19th Tactical Air Commands. Its size and complexity made it a sobering document. Consider, for example, the responsibilities of a single one of these organizations, the 9th TAC:

During preparatory phase (D minus 30 to D minus 1):

(a) Be employed in training and preparation for the invasion role.

(b) Provide fighter escort for bomber attacks of U. S. Strategic Air Forces and 9th Bomber Command.

(c) Provide fighter bombers for offensive operations as directed by 9th Air Force.

(d) Provide tactical reconnaissance supplemented by photo reconnaissance, as directed by the 9th Air Force.

(e) Provide necessary units and personnel to implement fighter control of fighter units of the command.

(f) Establish liaison with the First U. S. Army and execute the necessary details incidental to future joint operations.

(g) Co-ordinate with the commanding general, 19th TAC, in training and preparation of those units of his command which will be attached to 9th TAC in future operations.

During assault, build-up, and subsequent phases:

(h) Provide a force of *Thunderbolt* aircraft as high cover over the assault beach area.

(i) Provide a force of *Lightning* aircraft in convoy cover, and co-ordinate the participation of a force of *Lightning* aircraft of the 8th Fighter Command in the convoy cover.

(j) Provide a force of *Lightning* aircraft and a force of *Thunderbolt* aircraft for direct air support of the ground forces.

(k) Co-ordinate the employment of certain groups of *Thunderbolt* aircraft and certain groups of *Mustang* aircraft of the 8th Fighter Command in the provision of bomber escort for the 9th Bomber Command.

(l) Maintain certain groups of *Thunderbolt* aircraft and *Mustang* aircraft in reserve for use as directed by the Commanding General, 9th Air Force. It is probable that the major part of these groups will be used as fighter bombers for attacking coast defense batteries and other strong points in the enemy's defense system.

(m) Be prepared to operate all fighter and fighter bomber groups on a scale of four group sorties a day.

(n) Be prepared to furnish escort for troop carrier operations on D-Day and D plus 1.

(o) Provide a force of tactical reconnaissance aircraft to

execute tactical reconnaissance missions in direct support of the ground forces, on a scale of three group sorties a day.

(p) Be responsible for night fighter control through the 85th Group until relieved by the 9th Air Defense Command.

(q) Be responsible for aircraft warning and day fighter control activities in the American sector.

(r) As soon as R & R (refueling and re-arming) strips are available, co-ordinate their use by fighter groups of the command for the execution of such missions as may be ordered by the commanding general, 9th Air Force.

(s) As advance landing grounds and airfields become available, occupy them with fighter groups and execute fighter and fighter bomber missions in support of the First U. S. Army, and such other missions as may be ordered by the commanding General, 9th Air Force.

(t) Provide the necessary headquarters personnel and operational agencies to conduct operational control and command of all 9th Air Force units located on the far shore, until such time as the commanding general, 9th Air Force, establishes his operating headquarters on the far shore and announces his assumption of command.

Phew!

The responsibilities of the other Air Commands were equally comprehensive.

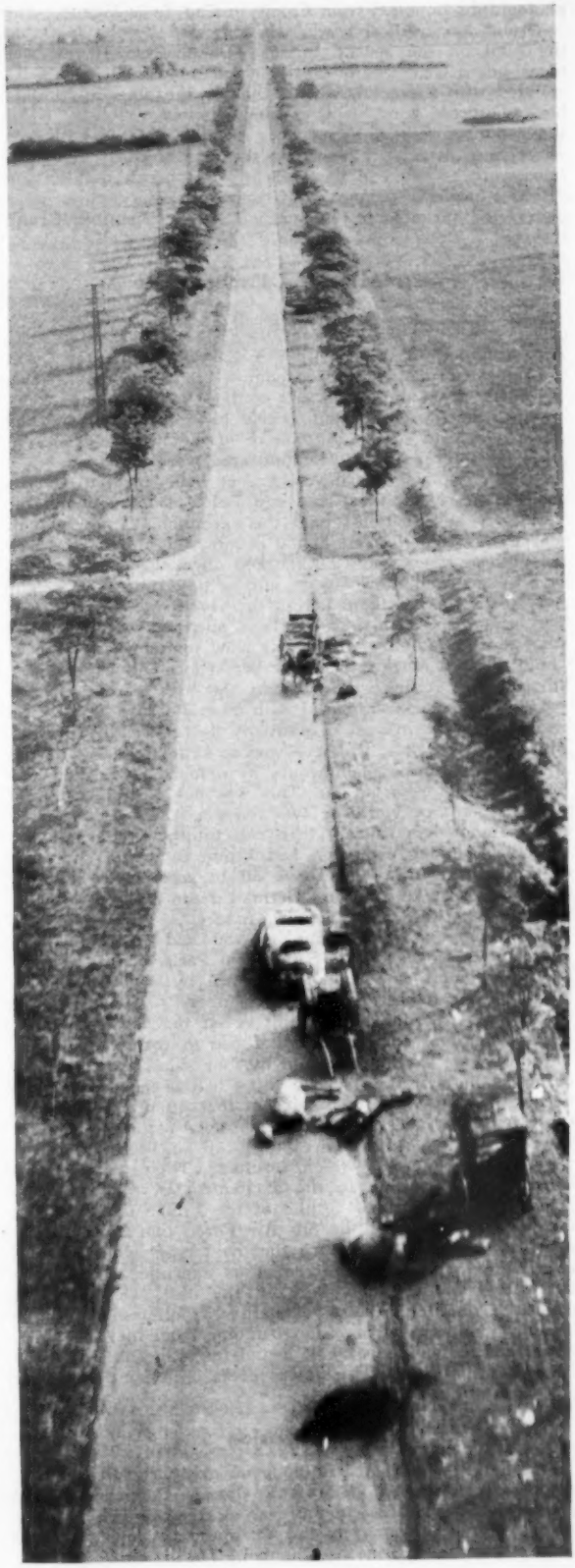
There was now a month and a half left, D-Day having been set for June 5 (it was later postponed 24 hours because of bad weather), and the landing area identified as a strip of beach on the Normandy coast between Cherbourg and Le Havre. This had been chosen after long examinations of the coastline and of the defenses erected thereon by the Germans. Also, its location with relation to the Seine and Loire rivers suggested that it could be isolated by cutting the bridges across them. Furthermore, enlargement of the beachhead there would result in possible early capture of the ports of Le Havre and Cherbourg. The perfect place for the assault would have been Calais, where the Channel is narrowest, where the beaches are the best for such a landing, and where excellent ports are near at hand. However, Calais beaches were much more strongly defended than Normandy and were on the wrong side of the Seine for successful implementation of the interdiction plan contemplated.

It was now necessary to obtain a more detailed knowledge of the beaches selected. Vertical photography had shown intricate barricades in the shallow water and on the sand, but could not show how strong these were, whether made of wood or concrete, whether anchored deep in the sand, whether they could be overrun by landing craft, or avoided by infantrymen storming the beach. The extreme hazard of taking low-level pictures of a strip so formidably defended made the invasion commanders hesitate to order any "dicing" runs until General Quesada, commanding the 9th TAC, offered to talk to members of his photo reconnaissance group, the 10th. He went down that night ready to suggest practice missions and diversionary attacks, but was met with such a blast of "Hell no. We're ready now. Just tell us what you want and we'll get it," that he went away and left the details to the group.

The first "dicing" mission was flown on May 6 in an F.5, a light, unarmed version of the *Lightning*, with a camera so mounted in the nose that it took a picture every five seconds, ahead and to the side of the plane. Earlier, *Lightning* pilots had been told that they might have to take photographs from as low as 29,000 feet. But that morning, 2nd Lieut. Albert Lanker crossed the Channel at 15 feet. He reached the other side at Bercq-sur-Mer, turning around a large sand dune to lessen his chances of being hit during the turn. His pictures later showed this dune to be an enemy gun position.

Then the superbuzz started. He encountered five groups of men at work on the beach defenses, "heading straight for each group just to watch them scatter and roll. They were completely surprised—didn't see me until I was almost on top of them." He was fired on repeatedly at point blank range by riflemen, but was not hit. He scaled a cliff at the end of his run, clearing the top by six feet, and got home safely. Later promoted to 1st lieutenant, he has been missing in action since December 26, during an attempt to drop photographs from minimum altitude to the beleaguered American troops at Bastogne.

All together 11 dicing missions were flown and superb



In protecting Patton's Loire flank against German counterthrust, the TACs hit everything that moved on the roads. The Germans were forced to move out into the open where they were trapped.

photographs obtained from Calais to Cap de la Hague. The inherent danger of this work is indicated by the fact that the pilot on the second mission, Lieut. Fred Hayes, was never heard from again. On the third, Lieut. Allen R. Keith collided with a seagull, which stuck in the glass in front of his bulletproof windshield, causing "limited visibility." But the assault forces got what they wanted. Mines with trip wires were detected attached to the tops of posts, gun positions were revealed in the sides of cliffs, weak spots in the defenses located. Thousands of copies of these pictures were distributed throughout the invasion army. The 10th Group received a Presidential citation.

Isolating the Battlefield

Also on May 6, the focus of bomber attacks on rails was considerably narrowed. From the 15th on, airfield attacks were confined to those within a 130-mile radius of Caen, to compel German fighters to operate from bases at least as far distant from the beachhead as those of the Allies. During the last few days innumerable last-minute preparations were made and in an atmosphere of mounting tension the plans for interdicting the landing area were activated.

The geography of northwest France lends itself to such a plan. Two rivers, the Seine and Loire, completely cut off Normandy and Brittany, with the exception of a small gap near Paris, from the rest of the country. If the rail bridges across these rivers could be knocked down the enemy would have to spend an enormous amount of time unloading freight and troops, taking them across the rivers by boat or pontoon bridge, and then reloading them on trains waiting on the other side. Not only would this slow up movement but it would tie up a much greater number of locomotives and cars. Further, the rolling stock within the area of interdiction (which could not be replaced with fresh stock as long as the bridges were down) could gradually be reduced by bomber and fighter attack until there was so little of it left in the area that the rail system would have to be abandoned and road transport resorted to. This was not desirable from a German point of view for two reasons. First, road transport is much less efficient than rail transport. Second, the strategic bombing campaign had begun to create shortages in trucks and tires, and above all in gasoline, a shortage which was soon to interrupt German dreams of victory with nightmares of the most fiendish nature.

Accordingly, a bridge campaign was laid on. By D-Day all the rail bridges on the Seine from Paris to the sea were down and, more important, kept down by a variety of attackers from fighters to heavy bombers. One bridge at Rouen was smashed and rebuilt seven times without ever staying up long enough to be of use to the enemy. The Vernon bridge was knocked out by four skip-bombing *Thunderbolts*, the first time such a thing had been accomplished in the theater. The other ships in the squadron which did the job scored direct hits on a munitions factory and came staggering home with their wings full of rocks from the tremendous explosions which resulted. Their triumph was completely overlooked in the excitement over the Vernon bridge. An analysis of results of the bridge attacks bears out the contention of the 8th Air Force that high-altitude operations by it against such narrow targets would not be rewarding in proportion to the effort expended. It showed that skip-bombing by fighters on the deck was the most effective (although most dangerous), followed by dive bombing and last by precision bombing from high altitudes. Nevertheless, the necessity of completing this job influenced SHAEF in putting all available forces on it and on a few 11th-hour rail yard attacks.

The Invasion

For D-Day itself an air plan of great complexity and scope was developed. The RAF Coastal Command would patrol the Channel for submarines. A constant fighter cover to protect the convoy from the air would be flown, directed from a control ship in the Channel. During the night two American airborne divisions would drop near the base of the Cherbourg peninsula and a British parachute division on the Orne river near Caen. Also during the night the RAF Bomber Command would saturate with its entire

Heavy bombers sometimes helped the TACs. Here is airfield at Neuberg, Austria, before 15th AF Liberators hit it on March 15.

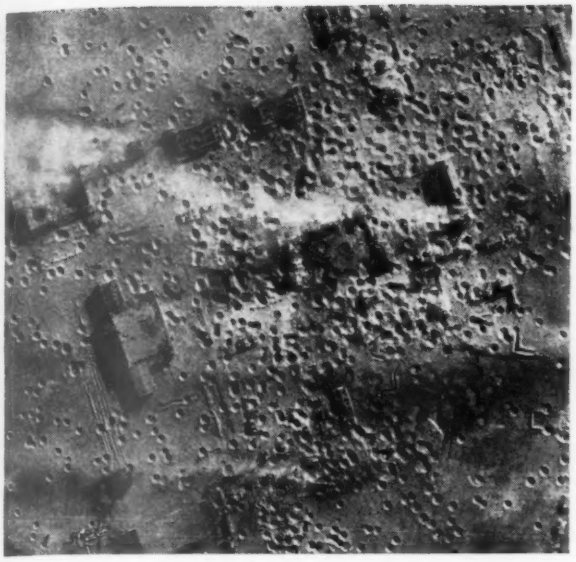
strength five selected rail yards in the immediate invasion area. At dawn, 1,200 8th Air Force heavies would begin to plaster the beach defenses themselves.

This latter operation was a delicate one. It was realized that direct hits on defense installations with more than five per cent of the bomb load were unlikely and that confusion and panic among the defenders would be the real dividend from the operation. For this reason, it would be necessary for the invasion fleet to hit the beach immediately after the bombing while confusion was still at its height. It was planned to wait 1,000 yards offshore during the attack and drive to the beach five minutes after the last plane had dropped its bombs, if the weather were good, 10 minutes if it were bad. In the latter event, the heavies would use radar bombing methods, approaching the coast at right angles and depending on the clear demarkation line between land and water which would show up on their radar scopes to enable them to drop sufficiently near the water to be effective, and at the same time avoid hitting ships on the water.

Finally, the great day came, and the electric phrase "this is it" was heard in hundreds of briefing rooms. The invasion armada steamed out of the British ports, the parachutists and glider troops droned off into the night, and the RAF went to work, dropping over 5,000 tons on five rail yards, at that time the greatest single lift in air warfare. By first light the American heavies had commenced their job, and at H-Hour the first assault troops crashed through barbed wire and mine fields onto French soil. As expected, the defenders in most places were dazed by the bombing.

But bitter fighting ensued along the entire coast, particularly in one zone of American responsibility where a complete German division had by pure chance moved in the day before for beach maneuvers. But the landing stuck. In two days it was clear that no immediate counterattack by enemy troops already in the area could be expected to push us back into the sea. Air had played its part. The GAF, as noted earlier, made only a puny effort, considering the cosmic nature of our attack. German submarines failed utterly to penetrate the shipping lane protected so carefully by naval forces and by the RAF Coastal Command.

Careful study of the enemy reaction immediately preceding and during the invasion makes it plain that complete surprise had been achieved by our forces, due in large part to a magnificently executed campaign on the part of the RAF to liquidate all enemy radar installations along the coast. It also appears that our aerial blows around Calais and down in the Nantes area were not wasted. For weeks the Germans believed that the Normandy effort was a feint



And here is the airfield after attack, showing a terrific concentration of bomb hits. Fifteen German planes were destroyed.

and the real thrust would come to the east where we had for a long time been planting bombs like nasturtium seeds.

Air followed ground right into the beachhead. By D plus 2, an emergency fighter strip had been cleared by aviation engineers who had one company defending the strip while the rest of the battalion worked on it. Others soon followed, and the 9th TAC, whose mission was to co-operate with the First American Army, moved in while the fields were still under fire. One of them endured heavy mortar fire for three weeks and also showers of fragments from our own flak, which went up like a curtain whenever an enemy plane appeared. As units reached the continent they came under the command of Gen. E. R. Quesada, commanding the 9th TAC. Those remaining in England were operated by Gen. O. P. Weyland, commanding the 19th TAC.

During the early days of the beachhead all went well. The British held the line along the Orne river, while the Americans fanned west and reduced the Cherbourg peninsula. But as our ground forces worked their way inland they ran into a type of terrain which put them further and further behind schedule. That section of Normandy, known as the Bocage country, is characterized by small fields edged with deep drainage ditches and stout, impenetrable hedges. The narrow winding roads are also hedge-lined. Each hedge became a fortress, each field a dangerous open space across which withering enemy fire spattered in such a way as to discourage frontal assaults. The Germans had succeeded, despite our rail attacks, in bringing up a ring of troops which contained our forces in the hedgerows for weeks. These were well dug in, their camouflage discipline excellent, offering few targets for fighter bombers. They moved only at night. The greatest success our air forces can claim for this period is in driving back the GAF from western France.

Troops and supplies were meanwhile poured into the beachhead in an unending stream. Units of another American Army, the Third, under the command of Gen. G. S. Patton, began to arrive. Soon the headquarters of the 19th TAC, which was assigned to operate with him, had moved over and had again taken charge of such of its units as had previously moved across and had been operated by General Quesada's 9th TAC. Allied personnel in the beachhead became almost solid, as the hedgerows continued to permit only the slowest and most painful advance.

Carpet Bombing

By the middle of July, the schedule had gone so alarmingly out of whack that the air forces were persuaded to dust off a bombing technique which had been tried and had failed previously in 1944 at Cassino. But the reason for failure was known and it was believed that it could be corrected. This technique is carpet bombing. It consists simply of dropping such a heavy concentration of bombs in a small area that the defenders are stunned and demoralized for a short time. Before they can recover, Allied troops are among them, mopping them up. Two carpet efforts were made from the beachhead. The first, a British show, was laid down near Caen on July 18. A five-mile advance was made but was not followed up quickly enough and the British troops soon lost their impetus when the enemy was given time to re-form and dig in. Despite this, another attempt was made a week later, this time by the Americans between Periers and St. Lo. It called for the dropping of 3,400 tons of HE by over 1,500 aircraft of all types in a space 7,000 yards long and 250 yards wide. American ground forces were brought up in strength as close as possible to the bomb line, and the bombers struck. Before the dazed Germans could recover their senses, the First Army had poured through the hole in the dam, and the rat race was on.

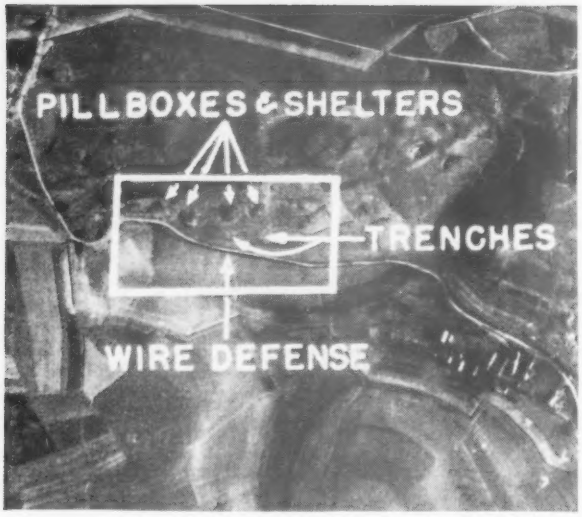
An analysis of the operation reveals some interesting facts. Enemy casualties amounted to less than 10 per cent, in some instances to only five per cent. This is because troops were well concealed in one-man foxholes and were not likely to be killed unless direct hits were scored on them. The damage to vehicles and weapons above ground was more serious. Communications were put in a state of chaos. But the real pay-off was in the psychological effect on the enemy. The endless stream of Allied aircraft completely destroyed the morale of several companies. Immediately after the attack scores of troops withdrew without orders and in utter confusion. This was the signal for others in the vicinity to follow suit. Prisoners taken were dazed, unable to co-ordinate or to think clearly. (After the Caen carpet attack numbers of them could not be interviewed by intelligence officers for 24 hours because they were unable to hear.) Many stated that the mere presence of vast numbers of aircraft unopposed overhead was sufficient to produce a mental state bordering on panic. One prisoner voiced the opinion that a loud-speaker threat to lay on a carpet attack in a certain sector at a given time would result in mass surrenders.

But this mental paralysis lasts not more than one or two hours. To take advantage of it, the attackers must be so placed on the ground that they can rush in before recovery can be effected. This means that they will be in considerable danger of being bombed by their own planes, which is what happened at St. Lo, where numbers of our troops were killed. However, if this calculated risk is not taken the operation may fail.

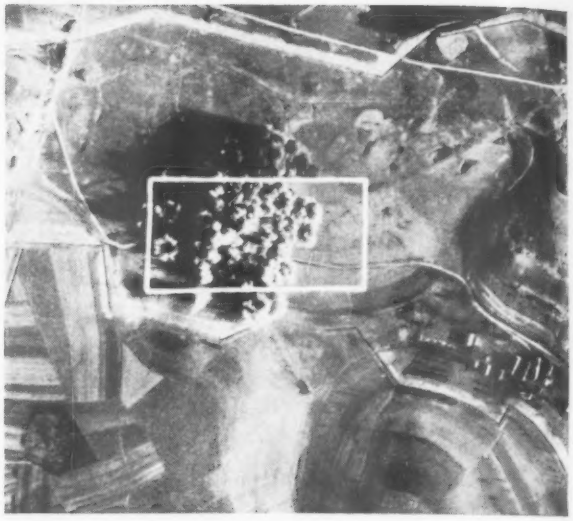
Stated another way, a ground situation such as existed at St. Lo poses the problem of softening up a hard shell of enemy resistance. Our troops can either withdraw to positions of safety before the attack, and hope to get back in time; or the bombing attack can be laid on at the rear of the enemy ring, and roll as close toward the Allied troops as the air and ground commanders consider advisable. The closer it comes, the easier the smashing of the defensive ring by our forces will be. This latter method seems to be the better of the two. At Cassino, our troops withdrew but so did the Germans. By the time we got back they were back. In November, 1944, during a carpet attack at Duren, we withdrew again in an effort to avoid casualties to our troops. But as we did so an alert enemy clawed his way forward and succeeded in getting inside the aerial haymakers thrown at him and the bombing effort was largely wasted.

Another problem posed by carpet attacks is that of cratering the area to such an extent that our vehicles cannot get through it with any speed. The ground forces want enemy positions destroyed but they want them destroyed without making a complete hash of the terrain. This problem has not been completely solved. However, inasmuch as the greatest dividends are psychological, the use of frags instantaneously fused is indicated. They have a profound psychological but no particular cratering effect.

It is not unreasonable to state that the carpet bombing at St. Lo changed the complexion of the war in France almost overnight. The paralysis of the hedgerows ended abruptly,



Knocking out obstacles to our advancing ground troops was a TAC objective. Here are defenses in Siegfried line needing attention.



On March 15 they get a going over from 1st TACAF Marauders. The bombs cut a swath through defense belt for advancing 7th Army.

to be followed by a war of extreme movement in which the American air-ground team was given its first chance to show its stuff. The 1st Army, under an umbrella of 9th TAC fighter bombers, widened the gap, charged a short distance south, then curled east in a giant wave, rolling up the German flank as it went. It was in danger of being cut off by a determined German counterattack at Avranches, but the air ended this threat, pulverizing concentrations of enemy troops and armor as fast as they were formed. A week after the break-through, Patton's 3rd Army followed the 1st through the gap and roared south as far as the north bank of the Loire river. After a swift mopping-up operation in Brittany, it too turned east and embarked on one of the most remarkable end runs in modern warfare. There were numerous lifted eyebrows in military circles at this rash maneuver, which apparently proposed to ignore the threat to Patton's flank of large enemy forces south of the Loire. But Patton had discussed the matter at length with the chief of the 19th TAC, which was to cover his advance.

"I am going to forget completely about my flank," he said, "if you can guarantee to protect it for me from the air."

"I can do that," replied General Weyland, "if I have the weather."

Patton took off. In a little over two weeks he had reached Paris. The weather held. In a month he was within 60 miles of Germany.

Weyland's job was threefold. In addition to knocking down bridges on the Loire and chivvying the German forces below it, he had to cover Patton's advancing tank columns, and at the same time was ordered to aid in the reduction of three ports in Brittany where German garrisons were stubbornly holding out. He soon found himself in the position of a man trying to stand on two chairs which were rapidly sliding apart beneath him on a slippery floor. The stretch became terrific. In no time at all, he was operating simultaneously in places 350 miles apart. How he managed this, at the same time continually moving his advance headquarters and his airfields to keep up with Patton as closely as possible, is one of the least publicized but most outstanding performances in a brilliant campaign.

The splitting of Weyland's effort was due to the ground force supply problem, which was severely aggravated by the German decision to hang onto all ports as long as possible. However, there is a school of thought that believes (particularly since air operations against St. Malo and Brest turned out to be quite inefficient in reducing these ports) that Weyland's forces might have been better employed in one direction only—forward. The large bags of men and equipment in the Falaise gap, at the Seine, and at Mons would probably have been even larger. Sufficient additional momentum might have been generated in Patton's drive to carry him through the Siegfried Line (his patrols actually reached it and found it very lightly held).

By the end of August, a third American Army, the 9th, under Gen. William Simpson, had landed in France, and with it another TAC, the 29th. This was composed of elements of both the 9th and 19th, and was commanded by Gen. Richard Nugent, formerly A-3 of the 9th Air Force.

Throughout August and into September, the TACs operated at maximum strength. The 9th Bomb Division, a new operational offspring of the 9th B.C. and now commanded by Gen. Samuel E. Anderson, had been working hard to close the Paris-Orleans gap in the interdiction line and at the same time hammering the Loire bridges. It now found itself virtually hamstrung in the extremely fluid situation which developed. It was forbidden to attack any more bridges, as our rapidly moving ground forces confidently expected to use them, and was reduced to further blows at the battered but surprisingly resilient rail system of northwest Europe. But the TACs went on a spree of destruction. Fluidity was their dish. It forced the Germans to move out into the open. It created vast pockets of troops and vehicles which were being squashed together between the British ground forces and the 1st American Army, both beginning to move rapidly in the direction of Paris. The most notable of these was the famous Falaise pocket, in which much of the personnel and equipment of the German 7th Army was lost during only a few days of unrelenting attacks. On August 18, for example, the British 2nd Tactical Air Force, operating with General Montgomery's armies, destroyed 1,159 motor vehicles and damaged 1,724, destroyed 104 tanks and damaged 96 (more than there are in an entire German Panzer Grenadier division), leaving an area of smoking, stinking wreckage which beggars description. A second jam-up and battle occurred on the banks of the still bridgeless Seine, where the Germans, now in desperate retreat for the haven of the Siegfried Line, found it as hard to move out of the zone of interdiction as it had been to move in. They attempted to set up one defense line after another, but always the threat of being flanked by Patton's careening tanks to the south of them forced further withdrawals. The last engagement of any size to take place in France was a bizarre affair which found German and American armies racing eastward side by side in the vicinity of Mons.

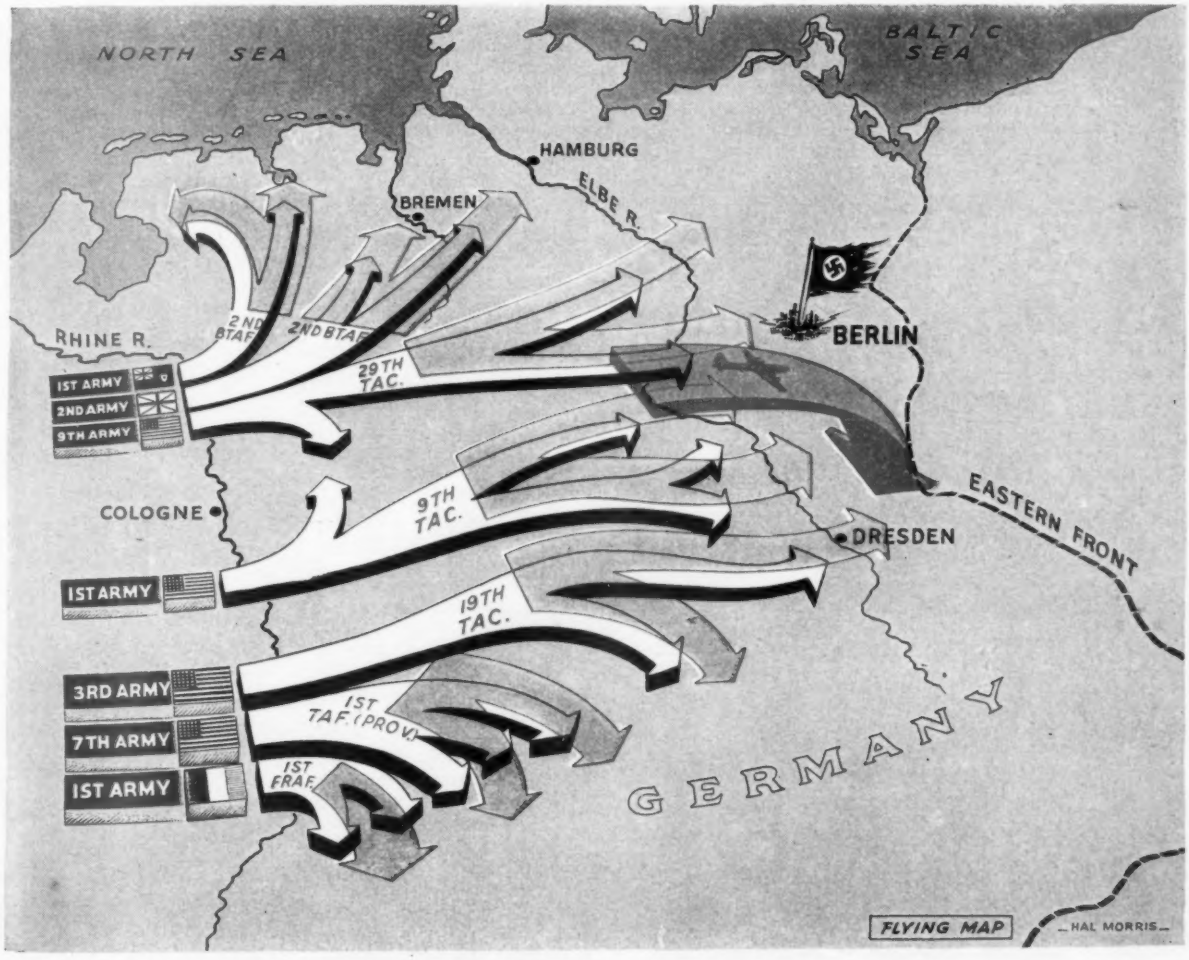
During those ripsnorting days, the principles of independence and interdependence were tested as never before. They were stretched, bent, twisted and wracked until it became clear for good and all that our basic concept of air-ground co-operation could stand up under the strongest hurricane that blew. It was valid in every respect but one: it didn't go nearly far enough. The speed of advancing tanks, the variety and number of targets offered, the confusion be-

tween Allied and enemy forces, all these and many other factors required co-ordination of the closest order at all levels: army, corps, and division. For example, the tables of organization under which the TACs operated were found entirely inadequate to supply sufficient numbers of air liaison officers, particularly in the case of the 19th TAC, which was faced with the problem of working with the swiftest armor (Patton's), each of whose divisions habitually advanced in two or three columns. An air party was needed in each, to travel with it on the ground and work out the best employment of the fighters which provided continuous daylight cover for the column.

How Armored Columns Were Covered

Close cover for an armored column is a specialized business. The incoming flight must know just where the column is and must be able to identify it. This is usually done by the use of colored panels displayed by the tanks. Colors must be changed daily (the Germans were soon detected displaying panels of their own). The flight must check with the flight which it relieves for the location of targets suitable for dive bombing, also with the air liaison officer riding with the tanks, to find out where the column is being held up and where it needs help. It must know where the tanks are going, and range ahead of them to spy out concentrations of enemy armor which may give them trouble. But like a good bird dog, it must not range too far (from 30 to 35 miles was found to be the useful limit). At all times it must be alert to ward off attacks on itself and the column by enemy aircraft. Traveling at high speeds is not conducive to perfect identification of targets from the air, particularly when the tank you are talking to is proceeding down the middle of a road and the enemy tank you are looking for may be lurking under a tree only 300 yards away. The air liaison officer (who should be a flyer) is very useful here in being able to describe to the plane overhead where the enemy armor is, in terms of terrain features which his own pilot experience tells him are readily identifiable from the air. His combat knowledge also prevents the tank commander from ordering dive-bombing attacks which are either impractical or impossible from the air point of view. If the liaison officer is unsuccessful in the target location to the fighter, the latter can order that a smoke shell of a distinctive color be put on it. Here again enemy ingenuity requires close co-ordination on our part, for the Germans may immediately fire a shell of the same color back at the American tank. To defeat this, the American tank notifies the plane as it fires: "One red smoke on the way!" giving the enemy no time to retaliate. This usually does the trick.

The Nazi rout continued as resounding triumphs were rung up by air and ground. The 1st and 9th Armies plugged remorselessly ahead against the main enemy resistance, aided by their respective TACs. The 19th TAC added to its laurels with its work below the Loire. A German force of 36,000 men in that area under the command of a Gen. Erich Elster could at any time and at any point for a hundred miles have driven a vicious barb into the Third Army flank. But Elster's movements were subjected to such constant aerial scrutiny,



Here are the routes of the Allied armies and their supporting tactical air forces into Germany. The heavy bombers (dark red) hit out ahead of the ground troops and the tactical air forces and by April 20, 1945, Germany had been virtually cut in two.

and any attempt to "snowball" his troops was met with such a blistering visitation of *Jabos* (German for dive bomber), that his threat remained theoretical. He was pinned down so tight that he found it impossible even to move out. When still another American army, the 7th U. S. (along with its own air partner, the 1st Tactical Air Force, Provisional) landed near Marseilles and moved north to join the Third Army in Eastern France, Elster had had enough. With 20,000 troops remaining, he surrendered to one of Patton's infantry platoons but insisted that Weyland, whose planes had caused him so much anguish, be in on the ceremony.

It is interesting at this point to see what the enemy himself thought of the relative effectiveness of Allied attacks. From captured documents and interviews with numerous prisoners of high rank, it is clear that the German General Staff regarded the Seine-Loire interdiction as the greatest thorn in its side, closely followed by the strategic oil campaign. The field commander and the common soldier, on the other hand, felt that they had lost the Battle of France because of the intensity and accuracy of Allied artillery fire and ubiquitous activities of the fighter bomber. As in a football game, it all seems to depend on where you sit.

Meanwhile the Breton ports fell. For weeks the sky over them was ten-tenths airplanes, as British and American heavies, mediums and dive bombers poured an unbelievable tonnage on Brest, St. Malo, and the Isle de Cezembre—three battered monuments to the uneconomical use of air power.

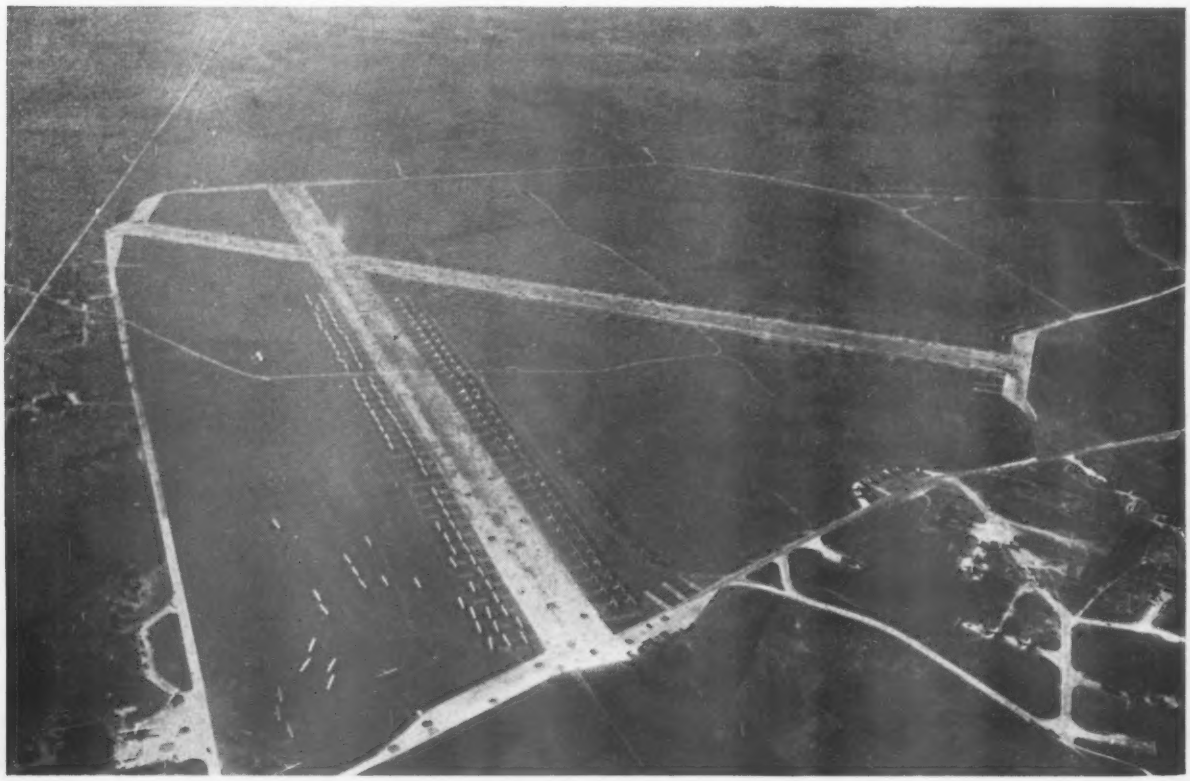
Patton's drive carried him right across France and almost into Germany. Here he stalled. He had run out of everything—gasoline, food, ammunition, maps. Attempts were made to keep him going with air supply, but this was not available on a large enough scale. He dug in west of the Metz forts, while all supplies were diverted to the north where the 1st, 9th and British Armies still had some momentum, the hope being that this momentum would last long enough to permit a flanking of the Siegfried Line and a crossing of the Rhine River in Holland. It is tempting to speculate on what would have happened if the entire lift of our strategic bomber force had been temporarily committed to the hauling of freight for the 3d Army. Heavies had been used before with success to drop supplies at low level to the Maquis in France. They were to be used again to supply the airborne landing at Wesel in March, 1945. With any sort of weather break they might have delivered from 1,000 to 2,000 tons of supplies a day to Patton.

Fortresses and *Libs* are admittedly inefficient cargo ships, but any sort of inefficiency is permissible if the prize is rich enough. Patton had reached the Siegfried Line *ahead of the enemy* and found it virtually untenanted. It is not inconceivable that he could have driven past Metz, through the Saar and even to cities deep in the south German plain.

Two arguments may be advanced against the use of a strategic bomber force for freight. The first is that it will interfere with the strategic bomber campaign. However, radar bombing methods (on which bad weather forced the 8th Air Force to rely for most of its operations from this period on through the winter) are comparatively unsatisfactory for precision work. And no bombing, however accurate, can deny the use of an industrial plant to the enemy as irrevocably as capture by ground troops.

The second argument is that flak takes a heavy toll of large, relatively slow aircraft flying near the ground. Our losses from *Liberator* resupply missions during the two airborne operations mentioned above bear this out. But the drop zones to which the heavies had to fly were surrounded by dense concentrations of light flak. In the area ahead of the 3rd Army this was not nearly so dense at that time.

October and then November rolled around, and with them a gradual deterioration of weather. The Battle of France was over. The airborne operation to flank the Siegfried Line was only a partial success. The Nijmegen bridge was captured and held but the forces which dropped 60 miles ahead at Arnhem were largely wiped out, partly through the inability of the ground forces to come up to them through the flooded lands that lay between, partly again through the limited capabilities of air resupply. The battle line at this



Plans were carefully drawn to fly the 1st Allied Airborne Army across the Rhine. Here the marshalling of the 17th Airborne Division's tow-planes and gliders is about to begin at Coulmier, France. But first the Nazi's major jet bases were knocked out.

time ran roughly north and south along the German western border At the top, in Holland, were the British and Canadians, and working with them the 2nd British TAF. Next came the 9th U. S. Army and the 29th TAC. Below them, in front of Aachen, Duren and the Cologne plain, were the 1st U. S. Army and the 9th TAC; below them, in front of Metz and the Saar, the 3rd U. S. Army and the 19th TAC. At the bottom, in the Strasbourg area, were the 7th U. S. Army and the 1st U. S. TACAF (Provisional). The French were also building a ground force in this area and had air elements in the 1st TACAF now commanded by Gen. Robert M. Webster.

With the front stationary, the various air commands were given time to effect much needed reorganizations within themselves. Their units had been hopelessly scattered throughout France during the mad rush eastward, their communications snarled, their supply and maintenance problems critical. Advance headquarters were established near the front and numerous fighter fields within easy striking distance of the enemy made operational.

The ground armies were now faced with the problem of hacking their way through an imposing barrier of natural and man-made defenses. Bitter battles were fought and progress was painfully slow. A series of rivers, the Moselle, Meuse, Roer, Oure, Erft and Saar, had to be crossed, and the Siegfried Line negotiated before we could draw up to the Rhine and jump off on the final assault against the war industries clustered in the Ruhr.

Air Activity in the Static Phase

The character of the tactical air war changed almost overnight The relation of TAC to Army became even more intimate than before as ground made even greater and more diversified demands of air to help it rout the sullen Hun from his deep concrete nests. The operations of the TACs during this period fall into four main classifications: tactical reconnaissance, photo reconnaissance, fighter bombing and night operations.

Tactical reconnaissance was, in the main, flown by *Mustangs.* Their job was to patrol certain designated areas over enemy territory and to report all enemy troop and rail movements therein, also to report immediately the location and nature of any enemy targets suitable for fighter bombing or strafing and to photograph the results of such attacks. In addition, they spent many profitable hours adjusting artillery for the ground forces. Talking directly by radio to an artillery battery, a TAC R plane would find out exactly where the artillery target was, then, when the pilot was in a good position to watch the target as he flew, the battery would fire one shell at his command. He would observe where it landed and call in a correction. This would be continued until the battery was zeroed in on the target. Then, "Let her go!" and concentrated fire would be laid on until the target was destroyed. Many of these targets were enemy gun positions and many of them were silenced in this manner.

However, the greatest dividend from artillery adjustment was that the enemy, seeing the deadly fire laid down when adjusted by a TAC R plane, eventually became extremely reluctant to fire his artillery at all when a *Mustang* was in the area. He knew that it would be only a matter of seconds before his position would be radioed in by the plane, a battery trained on it, and a round on its way. Thus relieved of harassing enemy fire, the progress of our ground forces became immeasurably easier.

Fighter bombing and strafing was done by *Thunderbolts.* They are more rugged than *Mustangs* and have greater fire power. Their job was simply to fly to points where targets had been found for them and destroy them. Teamwork between them and the TAC R ships became highly developed. The *Mustang* often stooged around until the *Thunderbolt* arrived, and then led it in to the target. At other times, *Mustangs* on artillery adjustment missions would be seriously bothered by flak and would call for help. *Thunderbolts* would oblige by attacking the flak positions.

Daylight reconnaissance was done largely by *Lightnings.* The variety of uses to which their photography was put is

After the landing, an area of three square miles was dotted with CG-4A's and British Horsa gliders. So effective had been the campaign against German fighter bases that not one of the 1,587 troop carrier aircraft that participated was lost to enemy air action.

amazing. They supplied the armies with basic coverage, front line coverage, road and river strips, dicing strips and obliques of various kinds. They also gave the air forces target, strike, and bomb damage assessment photographs. With the battle area covered with snow and the enemy well hidden, the value of photography in this phase of the war cannot be overestimated. It took considerable skill for a fast-flying TACR pilot to spot anything in the silent motionless winter countryside, whereas many juicy targets were discovered by interpreters examining in stereo the day's haul of a photo *Lightning*. A combination of vertical and oblique photography provided the ground commanders with material for detailed terrain studies upon which to plan their operations. One type of oblique, when covered with a carefully calibrated "Merton" grid, was found to be so accurate by the artillery that it was used by them for pin-pointing targets. Much of the credit for the development of photography for tactical uses must be given to the 67th Photo Group, whose personnel has displayed great ingenuity in anticipating the requirements of air and ground and in tearing down aircraft and rebuilding them in direct violation of all rules, so that they will accommodate the special cameras needed for special work.

Night operations fall into two categories, night intruder attacks by *Black Widows* and night photography by *Havocs*. Both were important, particularly the latter, as 90 per cent of the enemy's movements now took place under cover of darkness. The *Havocs* were equipped to take stereo strips, getting their light by dropping a series of magnesium flares or by using an Edgerton light, a huge affair built into the bottom of the ship and designed to uncork an 800,000-candlepower wink every few seconds.

The performance of these manifold and delicate tasks sounds easy. Actually, if it had not been for radar, their coordination would have been incredibly difficult, and impossible under the weather conditions which prevail in western Europe in winter. The use of radar in military operations is in its infancy but it has already permeated every phase of air warfare It is used for strategic bombing by both British and American heavies. It makes night fighting and intruder operations possible. It literally saved England in the Battle of Britain. And it provided for the control and direction of virtually every day or night sortie flown by the TACs during the past winter.

Pioneers in the MAAF

At this point attention may well be focused on another part of Europe where another air force was waging its own tactical war against Germany. This, of course, was the Mediterranean Allied Air Forces, who were already old hands at the invasion game. Space limitations of this article dictated that the essence of American tactical air power be examined through the medium of one air force. As the payoff tactical air force on the Western Front and one whose recent operations are the literal summing-up of American tactical air plans, the 9th was the obvious choice. This does not mean that the work of the MAAF can ever be overlooked or underestimated. All the experience, all the lessons learned the hard way by the MAAF were applied again and again to the air war in Western Europe. MAAF's units were the tactical pioneers, and are still doing a tremendously important job.

Known first as the Northwest African Air Force, the MAAF had acquired its new title at the close of 1943. By the end of October, 1943, the 9th Air Force headquarters staff had been transferred to England and its flying personnel and ground crews had joined the 12th Air Force, tactical, plus the new 15th Air Force, strategic, which was organized in October. As it worked out, the 15th often found itself in a tactical role.

Probably the lesson which proved most valuable to the planners of the Normandy invasion was learned from the MAAF's interdiction campaigns when the battle line stood well below Rome, at Anzio and Cassino. Here, for the first time, we met the enemy on the mainland with all his resources at hand. Here was a well-defined supply system, a network of rails and roads that had to be systematically cut in order to relieve our own troops, stymied on a narrow mountainous peninsula. Here, in short, was a test case.

Just before the Anzio landing, the MAAF went to work to knock out all airfields in the vicinity and then proceeded to keep them neutralized after the landing. Strategic air units attacked airfields farther back where long-range enemy bombers were based and where fighters staged for the front. Communications, of course, were continually pounded deep in enemy territory. By the time the Anzio-Nettuno landings started on January 22, virtually all lines leading into Rome were cut. During the preceding four days they were hit by nearly 2,000 tons of bombs dropped by *Mitchells* and *Marauders* of the 12th Air Force and *Fortresses* and *Liberators* of the 15th

When it became acutely apparent that additional measures were needed to help the ground armies get to Rome, the MAAF undertook the historic "Operation Strangle" across the narrow waist of Italy. This operation set the pattern for all interdiction campaigns to come. It was essentially a series of sharp one-two blows against the supply network of the enemy driving him from the railroads to motor trucks, then going after the piled-up traffic; forcing the increased use of shipping, then bombing that.

Between March 15 and May 20 there were 18 Axis divisions in the central Italian area, nine behind the Anzio beachhead and nine on the main southern front. Their combined supply consumption was estimated at 4,000 tons a day. To supply this, however, they had transportation facilities in the beginning equal to handling 80,000 tons a day: 20 times more than they required. Reduction of this supply potential began March 15. In two weeks the MAAF had reduced it from 80,000 to 4,000 tons a day, or just what the enemy required on a quiet front, and no more. The Allied offensive toward Rome started on May 11, whereupon the Axis supply requirements jumped to an estimated 5,500 tons. By May 20 two more enemy divisions had been moved from the north into the battle zone and this upped supply needs to 6,000 tons a day. But the MAAF threw the book at the supply lines, held the tonnage capacity to 4,000, and the enemy was forced to retreat.

At the optimum stage of operations just before the fall of Rome, the six major rail lines leading down the peninsula were cut at more than 100 places. In Italy, for the first time, *Thunderbolts* were used for extensive fighter-bomber operations against open stretches of railroad and for blocking tunnels. At pinpointing bridge targets, they proved even more effective than the *Mitchells* and *Marauders* whose bombing accuracy in this theater has been remarkable.

In preparation for the Allied landings in Southern France on August 15, bridges along the lower Rhine river were interdicted by MAAF with the immediate objective of preventing the Germans crossing from west to east toward Marseilles and Toulon. Partisans in the area farther north actually effected interdiction without any bombing. The objective was twofold: to prevent the Germans from moving in reinforcements from behind as well as keeping them from making lateral movements along the coast. Up to and including D-Day, the MAAF alone flew 12,790 sorties, inclusive of troop-carrying operations. On D-Day itself, 2,700 of the sorties were flown, or practically a fifth of the total. As a result of this tremendous campaign, the invading forces met almost no opposition. As one RAF pilot, escorting airborne troops put it, "We had a holiday—we did not fire a single gun. Our job was to blot out any antiaircraft fire that might have been brought to bear against the towing craft and gliders But there was absolutely nothing for us to do but hold a watching brief." There was not a single casualty to the gliders from enemy action.

Traditionally a Jack-of-all-targets, the veteran MAAF continued its attacks in Italy, hammered ports in Vichy France and Nazi-held Greece, and took a highly significant step toward assisting the Soviets. The first attack on the Balkan rail system took place on November 14, 1943, when Mediterranean-based bombers hit Sofia. Between April 1 and May 9, 1944, when the Russians had just edged into Romania and when the MAAF attacks were going full tilt, heavy bombers based in Italy spread destruction over the Nazi rail and air network in Romania.

An even more intensive campaign in co-operation with Russia was instituted in November, 1944. Because of its success and timeliness, it is discussed here in some detail.

Realizing that the drive of Russian armies through Hungary offered a good chance to utilize further its striking power

Fighter-bombers of the 19th TAC did this to the road between Frankenstein and Bad Durkheim. The trucks and artillery of what appears to have been a division were caught and virtually massacred. Such vehicles never reached the front to fight our troops.

against Nazi supplies, the 15th Air Force undertook a detailed analysis of the rail systems in Austria, Western Hungary and Yugoslavia. A comprehensive photo reconnaissance program was initiated. The resultant information, combined with reports from ground agents and prisoners of war, gave a clear picture of the traffic flow that was meeting the needs of hard-pressed Axis forces.

On December 23, the Russian high command requested bombardment of rail lines from the Linz area, northwest of Vienna, to Hungary and Yugoslavia, and the connecting lines to northeastern Italy. In view of this, and other considerations, the plan as finally developed involved the immobilization of rail centers running from Vienna down to Zagreb.

As the MAAF's attacks progressed, certain tactical factors became clear. Interdiction of through lines by bombardment of rail yards was temporary at best. Likewise, the destruction of repair facilities caused a Nazi headache but was not fatal. Plenty of alternative facilities were available. It was soon found, however, that an avalanche of bombs in a crowded yard played havoc with rolling stock and often immobilized all undestroyed stock.

Thus, while a through line could generally be restored in a few hours, no great amount of rolling stock was moved for one to three weeks. It therefore became the policy of the MAAF to select fleeting targets—the yards most heavily loaded—and to immobilize each while the remaining yards in the same system were attacked in similar fashion.

By the end of February, 1945, most of the important rail centers in the areas selected had been smashed.

Bombardment was not the only weapon available to the MAAF. The all-out strategic bombing of the German fighter aircraft and fuel industries in 1944 had weakened the enemy's fighter force. This, combined with the commitment of available German fighters to ground co-operation tasks, reduced the need for large-scale escort for our bombers. In turn, this permitted the use of our strategic fighters for strafing and dive bombing.

Our dive bombers were used to attack pinpoint targets not readily identifiable from high altitudes. The strafing plan, carried out in conjunction with virtually every bombing attack, was designed to add to the mounting total of destroyed locomotives and rolling stock. Also, it achieved a major degree of traffic interdiction by wrecking moving trains at numerous points on the main lines.

Thus the plan unfolded, always flexible, always directed at a single over-all objective: to prevent Axis men, weapons and supplies from reaching the Russian front.

Attacks by the 12th Air Force on the North Italian and Brenner routes reached a climax toward the end of March when in one week nearly 6,500 sorties were flown for the loss of 30 aircraft. In a final burst of glory, the MAAF opened up on April 16 with a mammoth attack in co-operation with General Clark's 5th Army driving the Germans out of Northern Italy. A bombardment by 1,233 heavy bombers of the 15th Air Force preceded the American jump-off in mountainous territory heavily mined and bitterly defended south of Bologna. Nazi defenses were saturated by nearly 25,000 bombs

But this is getting ahead of the story.

More Carpet Bombing

As winter closed in on the Western Front, ground progress nearly halted. Patton succeeded in getting past the Metz forts with the aid of heavy bombing by the RAF, the 9th Bomb Division and fire bomb attacks by the 19th TAC. To his north the 1st Army captured Aachen. If it could burst through a few more miles of very bad country it would find itself on the Cologne plain and could expect to get up to the Rhine without difficulty. But the Roer river, the Hurtgen forest, and several strongly defended towns stood in its way. To smash this formidable barrier, the largest carpet attack yet planned was laid on. This involved an all-out effort by both RAF and USAAF. Nine saturation points were marked out lying in a triangle between the towns of Linnich, Eschweiler and Duren. Elaborate measures were taken to avoid a repetition of the casualties to American troops which had marred the otherwise brilliant execution of the carpet bombing at St. Lo. Crews were carefully briefed, colored panels and smoke markers laid out to mark the American front line. Several alternate plans were developed

to cover changes in the ground situation and to allow for all weather contingencies. The operation came off on November 16, airmen reporting no difficulty in identifying friendly troops. The 8th put 3,679 tons on and around Eschweiler. The RAF smashed Duren, Julich and Heinsburg with 5,640 tons. The concentration on Duren was a remarkably heavy bombing performance. Eighty per cent of the town was obliterated, along with most of a German division which was there at the time. Mediums of the 9th Bomb Division and fighter bombers also operated at full strength. Air attacks were greatly facilitated by an extremely effective anti-flak barrage laid down by 1st Army artillery.

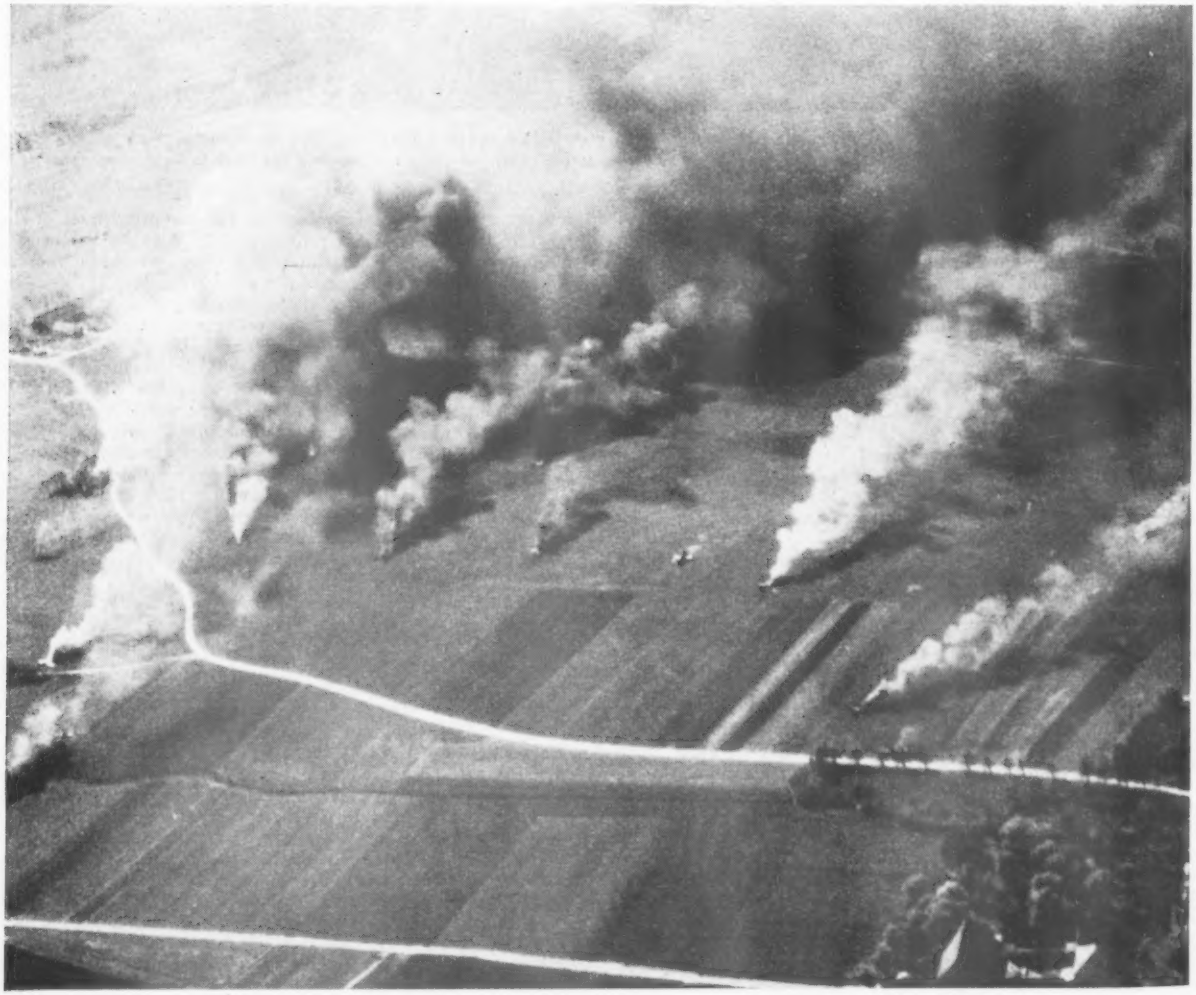
This gigantic effort should have sprung the 1st Army into the Cologne plain without further ado. That it did not is due to two things: failure of the bombers to hit close enough to American troops to soften the enemy defenses directly in front of them, and failure of our troops to push ahead with both infantry and armor while the fleeting psychological effects of the carpet still persisted. Prisoners again testified, on interrogation, to the near coma which is produced by carpet bombing But their remarks also pointed out with painful clarity how ephemeral this coma is. One captured NCO with 12 years' army experience stated:

"My men were young and inexperienced. I never saw anything like it. These men didn't even dare to stick their heads out of their fox holes. They didn't listen to orders and were still numbed 45 minutes after the bombardment. It was our luck that your ground troops didn't contact us until the next day. I couldn't have done anything with those men that day."

Another said. "The tanks arrived a full day ahead of the infantry. If the latter had been there at the same time, things would have looked really black."

As a result of this the 1st Army found itself still a long way from the Rhine, engaged instead in a bloody battle for the Hurtgen forest and the defended towns, which lasted for weeks. It finally staggered through to the Roer river but the Germans had time to withdraw across it in good order and set up another bristling defense on the other side. The situation was now further complicated by the presence of a number of dams on the Roer. Attempts to breach them from the air were unsuccessful, largely through our lacking a bomb which would penetrate deep into solid concrete. Such a bomb now exists, perfected by the British Admiralty for the piercing of concrete sub pens, but it was not in operational use at that time. Consequently, the ground forces hesitated to cross the Roer for fear the enemy would blow the dams and wipe out our troops in the ensuing flood.

This situation resulted in passing the ball to Patton, who meanwhile had reached the Prum, Saar and Moselle river area. Elaborate plans were made and a powerful force built up for a push there. The night before he was scheduled to jump off (December 17) the Germans under Von Rundstedt counter-attacked in the Ardennes.



The Luftwaffe is going up—in smoke. At least a dozen planes are flaming here after being strafed east of Munich by 8th AF fighters on April 16th. The 8th set an all-time record on that day by destroying 644 enemy craft on the ground, three in the air.

The Battle of the Bulge

The history of the Ardennes campaign is noteworthy on several counts. It was the first time American air power had been assigned a large-scale battle mission not planned in advance as part of an offensive. It was the first time an offensive had been launched by the Germans in nearly three years, the very first ever launched by them in this war without the assurance of complete local air superiority. It was a product of desperation, designed to relieve the unbearable pressures being exerted by the 1st and 3rd American Armies to the north and south. It also hoped to gain some respite for its nearly moribund oil industry by temporarily diverting the effort of Allied heavy bombers, and above all hoped to gain a little sorely needed time. It was planned with great care, and took advantage of every asset remaining to the enemy. The sector chosen for attack had been almost denuded of American troops. Its terrain was bad and its communications system meager, but far better fed by the German rail network to the east than by the Allied network to the west. Preparations for the offensive began on or about November 1. For a month and a half troops and supplies were moved forward in a steady stream, mostly at night. Allied intelligence was generally aware of the trend but failure to appreciate its magnitude stresses the necessity for continuous night photography to determine the intention of an enemy who moves always in darkness. The Germans counted on bad weather to limit Allied air activity, and must certainly have had forecasts of the zero-zero weather conditions which prevailed throughout December 18-22.

The plan was limited in scope. It called merely for a quick thrust west and then north to cut off the Allied armies east of Liege, Brussels and Antwerp, nothing more. To implement it, 22 divisions and about 600 tanks were committed to the initial assault with others held in immediate reserve. All available aircraft, amounting to over 1,000 mixed types were concentrated on adjacent interior airfields. At first things went well. A surge of German armor broke through the center of the Ardennes and rolled west with alarming speed. But efforts to widen this salient met with serious and immediate setbacks. On its southern edge, Bastogne, sitting astride a vital road system, was defended stubbornly. So was St. Vith to the north, which held out until an Allied line could be set up behind it running from Malmedy to Stavelot. The Germans attacked north and south with unrelenting ferocity, but the "Battered Bastards of Bastogne" were never taken, and the Malmedy-Stavelot line remained fast. Channeled thus into a few east-west roads, the enemy could move only westward. The farther he went the more extended and jammed his supply lines became, and the more vulnerable he became to air attack and to thrusts at his flanks by the rapidly gathering Allied ground forces. The deepest penetration was made by December 25, and as early as the 27th a precarious situation seemed fairly well in hand. A month after its birth the bulge was as good as hammered flat.

For a few days at the start, however, the outlook was extremely dark. Whole divisions of American troops had been swallowed. Communications were hopelessly scrambled. Nobody knew where the enemy was. The weather was atrocious with the entire area socked in tight. By December 21 the situation was so critical that a decision was made to attempt TAC R sorties at any risk. The size and location of enemy concentrations had to be obtained. In one instance, Captain Travis of the 12th TAC R Squadron took off with a ceiling of 50 feet and visibility of 100 yards. Twisting among the rain- and fog-shrouded hills he oriented himself and made a pass but the overcast was too low. He climbed up, looking for a hole, but found none. He obtained his position from the radar controller and went down twice more, skimming the tree tops and drawing heavy fire from hundreds of enemy troops and vehicles scattered through the countryside. Finally, on his fourth pass, he located his target and came home with the information needed. His exploit was only one of many. Flak and the GAF made further contributions to the ruggedness of air operation. Another recco pilot, Capt. John H. Holfker, was credited with three and a half enemy planes on December 17. On the 23rd he was bounced and bailed out over friendly territory. On the 28th he was hit by flak and bailed out again. This time he lit inside the German lines but hid in the snow by covering himself with his parachute. Hungry and half-frozen he finally made his way home. His comment: "I've been scared before, but never for so long."

On December 23 an unexpected break in the weather came, lasting until January 4. The hungry TACs made the most of it. The importance of channeling the enemy into a few roads now became apparent for these roads were worked over with a fury and thoroughness unequalled since the days of the Falaise pocket. Meanwhile heavy and medium bombers plastered towns, road junctions, airfields and rail installations east and west of the Rhine. Absence of complete photo cover, fragmentary prisoner testimony, and the enormous scale (104,000 tons) of this effort to isolate the battleground permit no exact estimate of its effectiveness. Nevertheless, a general picture may be drawn of the supply and communications problem. Men and supplies did get through but nothing could be relied on. Everything must have been late. The enemy, while not wholly cut off at any time from his rear, was fighting as exhausting a battle behind the front as he was on the front itself. Only by the most superhuman efforts was he able to keep bridges up and rail lines open. Bombing of certain towns caused great tie-ups. St. Vith was completely blocked for three days by a 1,700-ton attack by the RAF, prisoners testifying that it took them several hours to clamber over the debris and that vehicles could not make it at all. Houfallize was similarly blocked for two days by 900 tons. The 9th Bomb Division blocked La Roche for three days with only 150 tons, thanks to defiladed terrain, the presence of built-up areas abutting directly on the roads and smashing of a bridge over an unfordable stream. Such blocks naturally presented fat targets for the fighter bombers to chew on.

Although it flew an impressive number of sorties, the GAF was generally ineffective throughout the period. It failed entirely to interfere with ground operations and was only of a minor nuisance value in the air. The paralyzing attacks of our fighter bombers finally caused it on January 1 to make a large-scale strafing effort against our airfields which netted 127 Allied aircraft destroyed on the ground and 133 damaged. Of the 800-900 enemy planes involved, about 200 were destroyed in the air, equally divided between flak and fighters. We could afford such losses better than the Hun, our activity continuing undiminished while his dwindled. Between December 24 and January 16, the 8th Air Force hit 16 German airfields, the RAF two and the 9th Bomb Division two, interrupting operations for an average period of six days per airfield. Frozen ground added to the time required to repair runways and undoubtedly caused many crackups on landing. However, the great number of German fields makes it impossible to evaluate the effectiveness of these strikes. All together we lost 592 aircraft in the first four weeks of the Bulge Battle, 50 of these in the air. Against this we claim for the same period 1,392 destroyed, 129 probably destroyed and 418 damaged.

No man can ever attempt to balance the heroic stands at Bastogne and St. Vith against the operations of our fighter bombers in the bulge. However, the advancing infantryman, observing swarms of friendly aircraft with scarcely a sign of the enemy overhead, looking about him at roadsides littered with the hulks of charred trucks, tanks, self-propelled guns, and at one blasted supply dump after another, could see for himself what the TACs had done to help. In tanks abandoned because of factory-responsible breakdowns and because of the lack of fuels, in shattered towns with cratered streets he could also see the contribution of the bomber forces. Other things he could not see—things such as a disrupted aircraft industry which, although recovered in some degree, was a shadow of what Goering had planned; things such as interminable and repeated delays from train reroutings; things such as transport in the rear reduced to dependence on horse-drawn vehicles and charcoal-burning trucks, and things such as the very concept of the German plan which called for a short punch rather than a determined push to the West. Truly, the Bulge provides evidence *ad nauseam* that the field manual is right: you can't fight a campaign on the ground today without superiority in the air.

Finally, consider the ground claims of our fighter bombers for the month December 16 to January 16, bearing in mind that the biggest hauls came after this period, when organized German resistance in the Ardennes broke down. A couple of

little countries could fight a long war with equipment like this:

	Destroyed	Damaged
Aircraft on ground	66	58
Gun positions	299	197
Tanks and armored vehicles	751	509
Motor transport	6,037	3,178
Locomotives	584	657
Rail cars	4,217	7,117
Tugs	4	0
Barges	27	57
Buildings	1,178	573
Fuel and ammunition dumps	10	27
Oil tanks	10	0
Bridges	18	10
Tunnels	7	2

In addition, 654 rail-line cuts and 161 highway cuts were made by fighter bombers during these 31 days.

The Final Smash

With the Ardennes again in Allied hands, the ground forces resumed their task of crunching forward to the Rhine. The British and Canadians already were firmly anchored there at Nijmegen and it was planned to consolidate all our other forces along the west bank, preparatory to the launching of a giant double crossing north and south of the Ruhr Valley aimed at swallowing it whole. With the Ruhr and Saar gone and Silesia long gone, it was not expected that the Reich could hold out much longer. Before this could be accomplished the Third Army had to get through a very sticky area involving the crossing of the Prum, Saar and Moselle rivers and the capturing of Bitburg, Prum and Trier. This was done, aided by the now familiar close-co-operation work of 19th TAC. Meanwhile, the First Army cooled its heels on the west bank of the Roer, still held up by those damned dams. Several feints were made, hoping to get the enemy to blow the dams and get the water out of the way for good and all. Instead, he did something far more disagreeable. He opened the valves and let the water out just fast enough to keep the river at flood level for over two weeks. Finally it went down and the 1st jumped off, rolling all the way to Cologne in 10 days. Soon the 9th Army was also gazing across the Rhine's waters at the smoke-grimed factories of Dusseldorf.

The battles of the Roer and Saar rivers were the last that the Wehrmacht was to fight in the west with any degree of vigor. We had foreseen great difficulty in negotiating Germany's mightiest river but such was not to be. The enemy had cashed almost his last chip. Five years of war, three of mordant bombing which had reduced his cities and factories to cinders, the decimation of his regiments, the crystal-ball military inspiration of his Fuehrer, the presence of fresh and unnumbered armies on both his fronts and vast armadas in the sky over his head, all these produced in him a schizophrenia and despair which made the last great operation almost anticlimactic. Without pausing to draw breath, the 1st Army pushed across the Rhine below Cologne, setting up a bridgehead via the shaky Remagen bridge. This had long been a target for the 9th Bomb Division, and it stood up under the tread of American feet and the clank of American armor just long enough for a sizable force to get across. Then it sank beneath the waves to join the Rhine maidens and the other Rhine bridges laid low either by the hands of their builders or by Allied planes. In the next few days the 2nd British and 9th American crossed in strength at Wesel, aided by the largest one-day air-borne drop on record—14,365 troops and 1,345 tons of equipment delivered by 9th TCC aircraft and gliders alone. Patton burst across at Oppenheim, followed by Patch below Mannheim. Operating at breakneck speed against dwindling enemy resistance, these five armies thrust a series of air-protected and air-supplied columns down Germany's highways and around her cities, encircling the Ruhr.

The iron tentacles kept curling farther and farther, to Frankfurt-on-Main, Mannheim, Muenster, Hanover, Gotha, Schweinfurt, to places which not so very long ago were at the extreme limit of heavy bomber range. By April 20, Madgeburg and Leipzig had been taken and Patton had crashed across the Czechoslovak border with Dresden only a few miles ahead. Germany had lost the war so irrevocably that the German scene had degenerated into a maelstrom of blood-letting and destruction which was continued only because of the fanatacism of the Reich's gangster-leaders. Gone, through strategic bombing or capture, were 90 per cent of Germany's steel capacity, 85 per cent of her iron ore, 95 per cent of her hard coal, 100 per cent of her ferro-alloys, 100 per cent of her coke, 80 per cent of her lignite, 95 per cent of her fuel, 95 per cent of her synthetic rubber capacity, 70 per cent of her tire manufacturing, 55 per cent of her tank manufacturing, 75 per cent of her truck manufacturing. And, as each day passed, these percentages were growing higher.

Germany, by April 20, had been virtually cut in two. Tactical and strategic air forces smacked bridges across the Danube at Regensburg and other nearby places to keep anything from moving across the remaining slender waist toward Munich and the Bavarian Redoubt where, it was reported, Hitler and his henchmen would make a last stand.

And the *Luftwaffe*? Its condition was perhaps best expressed by a German POW from a flak outfit. He said his units had three simple rules: (1) If a plane is silvery looking, it's American; (2) If it's dark in color, it's British; (3) If it can't be seen at all, it s German.

By April 20, 55 per cent of all airfields in Germany had been captured. German aircraft were being crowded into fewer and fewer fields as each day passed which, together with the excruciating fuel shortage, explains why in the first 18 days of April our air forces were able to destroy 3,121 German planes of all kinds, only 400-500 of them in the air. This merciless clobbering, plus the fact that 35 per cent to 40 per cent of the aircraft industry had been captured and a great deal more lay in ruins from bombing, meant that the *Luftwaffe* finally had ceased to exist as a fighting force.

As for our air forces, all were now tactical. On April 16, General Spaatz announced the U. S. Strategic Air Forces would now play a solely tactical role.

Germany was seeing the final result of what she began when her dive bombers screamed down on Warsaw, Rotterdam and Coventry. What Germany had been able to dish out was literally microscopic compared to what she got. Her bombers destroyed only 17 per cent of London. Fifty-six large cities in Germany are 50 per cent to 80 per cent destroyed

Symbolizing what happened to Germany's rails, this locomotive was tackknifed at Muenster, a top rail target prior to Rhine crossing.

by Allied bombing. Thus, as it turned out in the final accounting, German air planners had made some crucial errors. They had overestimated the power of their air force and underestimated the potential power of the Allied air forces. They had failed to concentrate on gaining air superiority before proceeding with other air plans. They had failed to plan properly in the sense that we planned a truly strategic bomber offensive, aimed at Germany's war industry, while the Germans, in the battle of Britain, bombed almost indiscriminately. They had failed to organize air-ground co-operation to the extent that has made the Allied tactical air forces so successful. And, finally, in their insufficiency in the realm of ideas, they failed to discern even faintly on the horizon the overwhelming might of the strategic air power that had shackled their aircraft production and left them without the fuel to fly.

There is no man who can say the American tactical air forces have not superbly fulfilled the three missions of tactical air power as defined in FM 100-20: (1) Gain the necessary degree of air superiority. (2) Prevent the movement of hostile troops and supplies into the theater of operations or within the theater. (3) Participate in a combined effort of the air and ground forces, in the battle area, to gain objectives on the immediate front of the ground forces.

As the proud TACs roamed at will over the flattened foe, and as they were joined by the strategic air forces in mid-April, the scene in Germany was one of air power triumphant. It would be a long time before the evaluation boards and the other experts had made their final reports on what had been accomplished by American air power in this war, but as tactical and strategic air commanders looked about them in the shattered core of the Reich all, to a man, were confident of the final answer.

PROOF THAT OUR TACTICAL PLAN WAS RIGHT

Generaloberst Heinz Guderian, former chief of staff, German ground forces, and inspector general of armored units: "Lack of German air superiority in Normandy led to complete breakdown of the German net of communications. The German Air Force was unable to cope with Allied air superiority in the West."

General Feldmarschall Karl Gerd Von Rundstedt, commander-in-chief in the West before German surrender: "Three factors defeated us in the West where I was in command. First, the unheard-of superiority of your air force, which made all movement in daytime impossible. Second, the lack of motor fuel—oil and gas—so that the *Panzers* and even the remaining *Luftwaffe* were unable to move. Third, the systematic destruction of all railway communications so that it was impossible to bring one single railroad train across the Rhine. This made impossible the reshuffling of troops and robbed us of all mobility. Our production was also greatly interfered with by the loss of Silesia and the bombardments of Saxony, as well as by the loss of oil reserves in Romania."

Generaloberst Von Vietinghoff, supreme commander in Southwest (Italy): "On the Italian and the Western Front, all freedom of movement for reserves and tanks was denied during

The Limburg rail yards were bombed into a mad chaos as but one sample of the destruction wrought by 9th AF planes in Germany which immobilized the German divisions. Such bombings prevented the Nazis from supplying their troops or withdrawing them.

With G.I. tourists below and a Thunderbolt overhead, this view of Hitler's ruined Berchtesgaden symbolizes Germany's destruction. *Impact* says: "It belonged to a man who hid his head in the clouds, only to have the clouds . . . rain fire . . . that destroyed him."

daylight hours. Thus counterattacks were impossible. In isolated instances, when we were successful in assembling troops for a major surprise attack, it could only be done at night and then the Allies were always in a position to bring their air force into action at any desired spot in a few hours and thus frustrate every German attack."

General Feldmarschall Hugo Sperrle, commander-in-chief of *Luftflotte 3* until the fall of Paris: "Allied bombing was the dominant factor in the success of the invasion. I believe the initial landing could have been made without assistance from the air forces, but the breakthrough that followed would have been impossible without the massive scale of bombing, particularly of the German communications far in the rear.

"Allied air power was the chief factor in Germany's defeat."

War Diary of the 7th German Army High Command (General Dollman), June 11, 1944: "Since the beginning of the Allies' large-scale attack, our transport system has been under constant attack by their air forces. Because of the continuous bombing of the main roads and the constant disruption of the detours, some of which could be driven over only at night and could be kept open for only a few hours, it became evident even after the first three hours that troop movements by rail could not be maintained. Not only did the combat group of the 275th Infantry Division, parts of the combat group of the 265th Infantry Division, and the 353rd AT Battalion have to be unloaded after one-fourth of the distance had been covered, but the 17th Armored Infantry Division and the 8th Smoke Projector Unit, which were being carried by rail, also had to be unloaded because the route was blocked even before they reached the army boundary line.

"Troop movements and all supply traffic by rail to the army sector must be considered as completely cut off. The fact that traffic on the front and in rear areas is under constant attack from Allied air power has led to delays and unavoidable losses in vehicles, which in turn have led to a restriction in the mobility of the numerous Panzer units due to the lack of fuel and the unreliability of the ammunition supply . . .

"The following information, based on the first few days' experiences with the Allied deployment of air power, is reported by the Army Supreme Command to the Army Group B:

"1. Rail transport is impossible because the trains are observed and attacked in short order: under these circumstances, the expenditure of fuel and the wear and tear on materiel in bringing up *Panzer* units is extremely high.

"2. The movement of units by motor transport is possible only at night, and even then the highways and communication centers are continually bombed. The continual control of the field of battle by Allied air forces makes daylight movement impossible and leads to the destruction from air of our preparations and attacks.

"3. The army considers it urgently necessary that our own air force be used by day and night in order to neutralize the Allies' now unbearably overwhelming air supremacy."

Feldmarschall Robert Von Greim, Goering's successor as head of the air force, said just before taking a fatal bite of potassium cyanide: "I am the head of the *Luftwaffe* but I have no *Luftwaffe.*"

END

By FRANKLIN D. WALKER

IF THE Civil Aeronautics Administration could dictate policy, the Interdepartmental Air Traffic Control Board would be dissolved or stripped of most of its authority under the newly-constituted Air Co-ordinating Committee which represents Army, Navy, State and Commerce Departments and the Civil Aeronautics Board. A bitter foe of the IATCB since that potent agency was created to resolve differences arising between civil and military air groups during the war, the CAA several months ago presented to the Air Co-ordinating Committee, through Commerce, a demand that IATCB be eliminated. The Navy had earlier submitted a formal program for streamlining IATCB to meet peacetime conditions, but the plan was withdrawn soon after CAA presented its separate case.

The CAA demand for dissolution of IATCB was blocked by a 3 to 1 vote of the committee. Aligned against Commerce, which represented CAA, were Army, Navy and CAB. (The State Department participates only in cases having an international angle.) A sub-committee was then named to study the CAA proposal and report back. The sub-committee's vote on the question was the same, 3 to 1 against. When the Air Co-ordinating Committee reviewed the CAA proposal a second time the vote again was 3 to 1 against abolishing the IATCB.

Since that second session the Air Co-ordinating Committe has taken the logical step of appointing another sub-committee to determine the manner in which IATCB should be changed to function smoothly in a nation no longer at war. The streamlining probably will follow the blueprint drawn up by the Navy before the CAA went direct to the Committee with its proposal for dissolution. With the Army, Navy and CAB as supporters, the IATCB will retain its identity and its decisions will continue to be binding on all member-agencies.

The trouble between CAA and IATCB dates back to the early days of the war when the question of what to do about private flying was of paramount importance. To prevent the grounding of all civil planes, except air carriers, the IATCB moved in and induced the military to permit private flying outside certain areas. The IATCB felt such action was imperative in view of the apparent willingness of CAA to go along with any military ruling, however drastic. More recently, CAA and IATCB have been at swords points over airport designations. About 1,300 applications for designations have piled up in CAA and IATCB is blamed for that condition. The CAA has requested IATCB to abandon the designation practice and, despite Army and Navy objections, that request soon will be met. Because of disagreement on the question in IATCB, the case has gone up to the Air Co-ordinating Committee for final decision.

The Air Co-ordinating Committee (for merly the War Aviation Committee, court of appeals from split decisions of IATCB) as presently constituted can now branch out into the international field. Scheduled for early attention are international operating rights for American commercial and military aircraft, rights to air bases and airways facilities, foreign problems of the ATC and NATS, and assistance to foreign governments and airlines. Another project will cover consolidation of departmental publications. One such consolidation would merge into one document the directory of airfields, the bi-weekly notice to airmen and air navigation radio aids. Another would consolidate the present four publications on instrument approach procedures.

Probably Apocryphal

The crew of a B-17 at a southwestern training base worked frantically to free fused bombs that had become jammed in the bomb bay but finally gave it up as an impossible and dangerous job and the pilot swung the plane around toward the home airfield as his fuel supply began to run low.

As he approached the field, he called the tower: "Two-O-Three to Tower. Our bomb load is jammed and we are running low on fuel. What do you advise? Over."

From the tower came this message: "Tower to 203. Repeat after me slowly: 'Our Father which art in heaven——'."

High-speed Trainers

The Navy recently looked over and approved the design of a new-type advanced trainer, one that may exceed in speed and performance the standard combat fighter planes used in the Pacific. Navy's theory is that the use of jet or the jet-radial combination will produce military planes so fast that the gap between advanced trainers and the really "hot" combat types will be too great for students. The obvious answer is an advanced trainer that can more nearly match the speed of Navy planes built for battle. It is understood that the first such trainer, which will carry both a radial engine and a jet unit, probably will be in production by late winter. That trainer would be ideal in preparing pilots to fly the Curtis XF15C, said to be the fastest fighter ever produced for the Navy, and the Ryan *Fireball* (FR-1). Both are jet-radial jobs.

The Army Air Forces, according to information disclosed at hearings before a Congressional appropriations subcommittee, has made no provision for trainers in 1946. The AAF will utilize present combat types, jets, radials and in-lines, for training purposes.

Curtiss Secrecy

The Curtiss-Wright announcement that its research engineers had developed several special flying devices which have attained speeds in excess of 1,400 m.p.h. has created much speculation among the aviation "experts." One aeronautical engineer-pilot said emphatically that Curtiss had worked out a television-guided craft that embodied a liquid fuel rocket and some application of the athodyd (aero thermo-dynamic duct, or continuous duct engine). It is his belief that the liquid rocket provides the power to send the device to the desired altitude and the athodyd, which must be in motion before it can begin to operate, then takes over. Value of the athodyd as a source of power is that it has no moving parts, but it has always been considered only as a source of auxiliary power. Dr. C. C. Furnas, Curtiss research director, has said that the flying devices are not rockets nor missiles. That they are the first of the pilotless guided aircraft forecast by Gen. H. H. Arnold appears highly probable.

No Navigator

When an international air transport plane heads out over the Atlantic or the Pacific, it carries four licensed crewmen, pilot, co-pilot, radio operator and flight engineer. The navigator is ignored. In an attempt to remedy that situation, the Institute of Navigation has recommended that CAA begin licensing all navigators who can meet high standards. According to Lieut. Comdr. Gordon A. Atwater, eastern vice-president of the Institute and chairman-curator of Hayden Planetar-

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PLANES
OF THE GERMAN AIR FORCE

The editors of FLYING review the excellent aircraft that were largely beaten only by the Luftwaffe's own strategic errors.

TECHNICALLY, the German air force was one of the world's best, even at the end of the war. It surpassed the Russian and Japanese air forces in quality and quantity, and might even have been a serious match for the American and British air forces in 1944-45 had it not been for certain major German strategic blunders that literally defeated the German air force on the ground. Two major factors crippled the *Luftwaffe:* Allied air attacks on German fuel production grounded German planes for lack of fuel; high combat losses of experienced pilots, plus lack of fuel with which to train effectively new pilots, did the rest.

German aeronautical engineers apparently would try anything—*anything*—once. To achieve mass production they concentrated on a few major combat types but there was no limit to the extent they would experiment with those types. The Messerschmitt Me-109 served the *Luftwaffe* throughout the war as a staple fighter and still was going strong at the end. The Focke-Wulf Fw-190 also was a veteran. But the number and extent of the modifications to each of these basic designs continued at a great rate from 1939 to 1945.

The Fw-190 went through even more drastic evolution. It started with an air-cooled radial engine (which in itself was considerably stepped up in power), then went to a liquid-cooled engine with even more horsepower. Then there was a stub-winged version, the more or less standard-winged version, and an unusually long-winged version; they eventually went back to the standard wing.

German engineers improvised and experimented with everything in their air force in much the same way. They hooked a V-1 power unit onto an odd-looking single-seat Henschel fighter design; it worked, but not very successfully. Their experiments with jet propulsion and rocket power were fantastic. When the war ended they were well ahead of us, with jet propelled bombers already flying, rocket-propelled bombs already in use, supersonic aircraft experiments and a vast number of other developments.

While German aircraft designs were good, the manufactured aircraft themselves were noticeably inferior to their earlier predecessors toward the end of the war. Workmanship was poor, quality of materials had deteriorated. American air force men operating a number of captured German aircraft in this country have the greatest difficulty keeping the planes flyable. The best German engine cannot be run without overhaul over 25 per cent of the time-before-overhaul considered normal for an average American engine. In later production jobs, like the Messerschmitt Me-262 jet fighter, there is evidence of bad design as well; the electrical wiring systems in nearly all of the newer German aircraft are a

(*Continued on page* 120)

Manufacturer	Designation	Typical Engines	H.P. Each Engine	Span	Length	Height	Gross Weight (lbs.)	Empty Weight (lbs.)	Max. Speed (mph)	Range (miles)	Service Ceiling (feet)	Remarks
Arado	Ar-96B	Argus As-410	360	36′0″	28′8″	8′8″	.....	.....	211	685	23,000	Advanced trainer.
Arado	Ar-196A	BMW-132K	900-920	43′2½″	33′10″	16′5″	8,200	6,580	195	670	23,000	Seaplane bomber.
Arado	Ar-232	2 BMW-801	1,600	110′0″	77′2″	18′8″	46,600	36,600	.....	.....	.....	Transport, 20 small wheels.
Arado	Ar-232B	4 Bramo BMW-323	1,000	110′0″	77′2″	18′8″	46,600	36,600	211	658	.....	Transport, 22 small wheels.
Arado	Ar-234B	2BMW-003 or 2 Jumo-004	Jets	47′4½″	41′7½″	13′8½″	22 000	.....	470	.....	37,700	Jet recon. bomber.
Arado	Ar-240	2DB-603 or DB-605	(1), (2)	54′6″	39′9″	.....	.....	.....	350	.....	.....	Recon. fighter-bomber
Arado	Ar-432	4 Bramo BMW-323	1,000	110′0″	77′2″	18′8″	46,600	36,600	211	658*	.....	Like Ar-234B, compos. wood metal.
Bachem	BP-20	1 Walter Rocket	Rocket	13′0″	20′6″	.....	3,765	.....	600+	25	.....	In development only.
Blohm and Voss	Bv-138B	3 Jumo-205C	600	88′7″	72′3″	.....	34,100	17,860	170	2,000	.....	Flying boat.
Blohm and Voss	Bv-139	4 Jumo-205	600	88′5″	64′0″	14′7″	38,500	.....	196	3,100	12,136	Observation.
Blohm and Voss	Bv-140	2 BMW-132	880	.....	.....	.....	18,700	13,860	199	1,550	.....	Recon. torpedo-bomber.
Blohm and Voss	Bv-141B	1 BMW-801	(3)	66′0″	49′0″	.....	9,700	.....	220*	.....	.....	Asymetric reconnaissance.
Blohm and Voss	Bv-144	2 BMW-801	(5)	.....	.....	.....	28,900	.....	.....	930	.....	Transport.
Blohm and Voss	Bv-142	4 BMW-132H	830	96′9″	64′7″	15′6″	36,380	22,930	248	2,732	22,305	Transport.
Blohm and Voss	Bv-155C	2 DB-603U	1,810	.....	.....	.....	.....	.....	428	.....	55,200	High-altitude fighter.
Blohm and Voss	Bv-222	6 Bramo BMW-323	1,000	157′0″	105′0″	18′4″	101,000+	42,000	210	3,720*	26,000	Transport & bomber flying boat.
Blohm and Voss	Bv-238	6 Jumo-222	2,500	197′0″	.....	.....	198,000	.....	.....	.....	.....	Resembles Bv-222
Bucker	Bu-181	1 Hirth Hm-504	105	34′9″	25′5″	6′5″	1,650	1,053	133½	500	16,400	Trainer.
(9)	Dfs-228	1 Walter 509D	Rocket	.....	.....	.....	9,000	.....	.....	450	80,000[4]	Launched from Do-217 at 33,000 ft.
(9)	Dfs-230	None	None	.....	.....	.....	4,600	.....	.....	.....	.....	Glider.
(9)	Dfs-332	None	None	49′2″	.....	.....	.....	.....	.....	.....	.....	Glider for testing wing sections
(9)	Dfs-346	2 Walter Rockets	Rocket	.....	.....	.....	.....	.....	1,700	.....	100,000[4]	Projected rocket craft.
Dornier	Do-1722	2 Bramo BMW-323	1,000	59′1″	52′5½″	15′9″	19,000*	11,500*	255	745	29,600	Bomber.
Dornier	Do-18K2	2 BMW-132N	865	77′9″	63′1″	17′9″	30,000	.....	186	2,700	.....	Military flying boat.
Dornier	Do-24	3 BMW-132DC	760	88′7″	72′1½″	17′10″	29,700	17,011	190	2,050	17,400	Recon. flying boat.
Dornier	Do-26K	4 Jumo-205C	600	98′5″	80′4″	22′6″	44,090	22,450	208	5,600	.....	Bomber-reconnaissance.
Dornier	Do-214	8 double DB-603	(1)	197′0″	.....	.....	.....	.....	.....	.....	.....	4 tandem, pusher and tractor transport.
Dornier	Do-215	2 DB	1,175	59′1″	53′6″	15′9″	18,960	11,685	312	1,500	24,230	Bomber.
Dornier	Do-217E1	2 BMW-801A	1,580	62′5″	56′6″	.....	33,800*	19,190*	315*	1,500	19,100	Medium bomber.
Dornier	Do-217K2	2 BMW-801A	1,580	80′5″	56′6″	16′8½″	.....	.....	.....	.....	.....	Medium bomber.
Dornier	Do-317	2 DB-603 or 2 DB-610	(1), (2)	67′6″ or 85′0″	.....	.....	.....	.....	.....	.....	.....	Span based on power: projected
Dornier	Do-335A	2 DB-603E in tandem	2,000*	45′4″	45′6″	16′5″	21,160	.....	477	868	37,400	Front and rear props.
Dornier	Do-435	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Projected development of Do-335.
Fieseler	Fzg-76	Impulse duct	.....	17′6″	25′4½″	.....	4,700	1,800	390*	150	10,000	Flying bomb (V-1)
Fieseler	Fi-156K	1 Argus As-10C	240	46′9″	32′6″	10′0″	2,920	2,050	109	630	17,000	Communications, recon.
Fieseler	Fi-256	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Enlarged Fi-156; 5 passengers.
Focke-Wulf	Fw-154	2 unknown	.....	.....	.....	.....	.....	.....	.....	.....	.....	Wooden fighter.
Focke-Wulf	Fw-187	2 unknown	1,000	51′0″	33′0″	.....	14,000	.....	360	.....	38,700	Fighter.
Focke-Wulf	Fw-189A	2 Argus	450	60′5″	39′5″	12′0″	7,500	5,930	215	430	27,550	Ground support; training.
Focke-Wulf	Fw-190D	1 Jumo-213 or DB-603	(1), (6)	34′6″	33′11″	.....	.....	.....	440	525*	38,000	Fighter.
Focke-Wulf	Fw-191	2 Jumo-222 or 4 DB-605	(7) (2)	82′0″	63′0″	.....	48,700	.....	.....	2,200	.....	Heavy bomber.

Manufacturer	Designation	Typical Engines	H.P. Each Engine	Span	Length	Height	Gross Weight (lbs.)	Empty Weight (lbs.)	Max. Speed (mph)	Range (miles)	Service Ceiling (feet)	Remarks
Focke-Wulf	Fw-198	1 unknown	1,000	41'0"	31'6"	.....	7,000	4,700	370+	550	34,500	Fighter.
Focke-Wulf	Fw-200K2	4 BramoBMW323R-2	850	108'3"	78'3"	23'4"	48,500	.....	279*	2,200	21,500	Reconnaissance-bomber.
Focke-Wulf	Fw-290	1 Jumo-213	2,000*	.....	.....	.....	.....	.....	400+	.....	.....	Improvement on Fw-190.
Focke-Wulf	Fw-300	4 Jumo-222 or DB-603	(7), (1)	152'0"	102'0"	.....	.....	.....	.....	.....	.....	Design stage only.
Focke-Wulf	Ta-152B	1 Jumo-213E	1,750	34'5"	33'11"	13'0"	.....	.....	428	.....	.....	Tank redesignation for Fw-190D.
Focke-Wulf	Ta-152H	1 Jumo-213E	1,750	48'6"	33'11"	13'0"	.....	.....	412	.....	.....	Pressurized; new wing.
Focke-Wulf	Ta-154A1	2 Jumo-211N	1,500	52'6"	41'3"	12'½"	18,600	.....	382	1,195	31,200	Night fighter.
Focke-Wulf	Ta-183	1 He So-11	Jet	.....	.....	.....	.....	.....	590	.....	.....	In development.
Focke-Wulf	Ta-254	2 Jumo-213E	1,750	.....	.....	.....	25,300	.....	460	.....	.....	Developed from Ta-154C.
Focke-Wulf	Ta-400	6 unknown	.....	137'9"	92'5"	.....	.....	.....	450	3,000	.....	Jet assisted; projected.
Gotha	Go-242	None	None	79'0"	52'6"	11'4"	8,500	3,200	.....	.....	.....	Glider.
Gotha	Go-244	2 Gnome-Rhone-14M	750*	79'0"	52'6"	11'4"	17,500	11,500	169	375	.....	Powered version Go-244.
Gotha	Go-345	None	.....	67'0"	41'4"	.....	.....	.....	.....	.....	.....	Glider, loads thru nose.
Heinkel	He-111Hae	2 Jumo-211F	1,340	74'3"	54'6"	13'9"	27,400	17,000	254	1,100	24,100	Bomber.
Heinkel	He-111Z	5 Jumo-211	(5)	115'0"	53'7"	13'9"	47,000	33,000*	298	1,180	.....	2 He-111's joined together.
Heinkel	He-113	1 DB-601N	1,200	31'0"	27'0"	8'0"	5,700*	.....	380*	433	37,500	Fighter.
Heinkel	He-114	1 BMW-132N	800	44'6"	39'0"	.....	7,656	5,148	208	540	22,960	Reconnaissance seaplane.
Heinkel	He-115	2 BMW-132K	880	75'9"	57'1"	23'4"	20,020	11,670	220*	1,400*	21,320	Recon. torpedo, mines.
Heinkel	He-162A	BMW-003-EI	Jet	23'7¾"	29'8½"	.....	5,940	.....	522	242	39,400	Jet fighter.
Heinkel	He-177A	2 DB-610	(5)	103'1"	72'0"	21'11"	68,000	.....	290	2,000	26,500	Heavy Bomber.
Heinkel	He-177A7	2 DB-610	(5)	120'0"	72'0"	21'11"	68,000	.....	290	.....	26,500	Similar to He-177A
Heinkel	He-177B	4 DB-603A	1,750	103'1"	72'0"	21'11"	.....	.....	.....	.....	.....	Similar to He-177A.
Heinkel	e-178	1 He-S3	Jet	.....	.....	.....	.....	.....	.....	.....	.....	First jet aircraft to fly, Aug., 1939.
Heinkel	He-219A	2 DB-603A	1,500	60'8"	51'0"	14'5"	29,900	.....	385	1,335	30,500	Dive or attack bomber.
Heinkel	He-219B	2 Jumo-222E/F	2,500	.....	51'0"	14'5"	32,550	.....	435	.....	.....	Did not enter service.
Heinkel	He-274	4 DB-603	(1)	145'0"	73'0"	.....	77,000	.....	310	.....	.....	Transport bomber based on He-177
Heinkel	He-280	2 BMW-003	Jet	39'4"	34'1"	.....	9,550	.....	.....	.....	.....	Jet fighter, abandoned.
Heinkel	He-343	4 jet units	Jet	.....	.....	.....	.....	.....	.....	.....	.....	Projected, abandoned.
Henschel	Hs-126	1 BMW-323-A2	1,000	47'7"	35'7"	12'2"	7,250	.....	220	440	27,000	Ground support.
Henschel	Hs-128	2 unknown	.....	.....	.....	.....	.....	.....	.....	.....	.....	Forerunner of Hs-130.
Henschel	Hs-129B	2 Gnome-Rhone 14M	750*	44'6"	33'3"	11'0"	11,400	8,940	275	690	29,500	Attack bomber.
Henschel	Hs-132	1 Jumo-004	Jet	40'0"*	.....	.....	.....	.....	495	.....	.....	Dive; wooden wings, metal fuselage.
Henschel	Hs-130E	2 DB-603S or T plus 1 DB-605T	.....	108'0"	64'8"	.....	38,000	.....	320	.....	45,-50,000	3rd engine pressurizes cabin.
Henschel	Hs-293	Rocket unit	Rocket	10'-15'	6'-10'	.....	2,500*	.....	350?	.....	.....	Radio-controlled glider bomb.
Junkers	Ju-52 3/M	3 BMW-132A or T	830	95'10"	62'0"	14'10"	24,200	14,325	195	800	18,000	Cargo transport.
Junkers	Ju-86	2 Jumo 207 or 208	1,000	84'0"	53'0"	15'8"	25,400	.....	260	980	42,600	High altitude recon. bomber.
Junkers	Ju-87D1	1 Jumo-211J	1,350	45'4"	35'6"	12'9"	14,500	.....	255	1,200	24,000	Dive bomber.
Junkers	Ju-87D5	1 Jumo-211J	1,350	49'2½"	36'5"	13'0"	14,500*	.....	255	1,200*	24,000	Jettisonable undercarriage.
Junkers	Ju-88A6	2 Jumo-211G	1,200	60'3"	47'1"	15'9"	29,040	16,874	295	1,500	29,250	Multi-purpose bomber.
Junkers	Ju-88G	2 Jumo-213E	1,750	65'8"	47'1"	15'9"	32,350	.....	402	1,500*	.....	Night fighter, radar.
Junkers	Ju-90	4 BMW-132H	880	114'10"	86'3"	21'0"	49,000	29,920	236	1,300	23,620	Troop transport.
Junkers	Ju-90S	4 BMW-801	(3)	137'6"	91'9"	.....	55,000	.....	260	1,250	.....	Bomber and transport.
Junkers	Ju-136	4 unknown	.....	.....	.....	.....	.....	.....	.....	.....	.....	Projected 4-engined Ju-86.
Junkers	Ju-188A	2 Jumo-213A	1.776	72'6"	49'0"	.....	32,000	.....	325	1,550	33,000	Medium bomber.
Junkers	Ju-248(8-263)	Rocket unit	Rocket	31'2"	26'0"	.....	.....	.....	590	109	49,000[4]	Development of Me-163B.
Junkers	Ju-287	4 or 6 BMW-003-A1	Jet	66'0"	60'0"	.....	47,500	.....	537	1,175	.....	Jet bomber; prototype only.
Junkers	Ju-252	3 Jumo-211	(9)	.....	.....	.....	.....	.....	.....	.....	.....	Larger, faster than Ju-52.
Junkers	Ju-288	2 Jumo-222	(7)	60'0"	52'0"	.....	38,900	.....	410	3,720	.....	Bomber: not based on Ju-88
Junkers	Ju-288C	2 DB-610A/B	2,950[5]	75'6"	54'2"	.....	50,600	.....	385	.....	.....	Pressurized bomber.
Junkers	Ju-290	4 BMW-801D	1,700	138'0"	92'6"	22'6"	88,000*	52,000	280	3,785	19,700	Transport and bomber.
Junkers	Ju-352A	3 BMW-323R2	1,000	112'0"	79'4"	.....	43,000	27,500	.....	1,860	.....	Troop carrier, transport.
Junkers	Ju-388J	2 Jumo-222E/F	2,500	.....	.....	.....	32,350	.....	414	1,400*	.....	Pressurized night fighter.
Junkers	Ju-390	6 BMW-801E	1,600	165'0"	.....	.....	161,000	.....	280*	4,970	.....	Transport.
Junkers	Ju-488	4 BMW-801	(3)	100'0"	66'8"	.....	.....	.....	.....	.....	.....	4-engined version of Ju-188.
Junkers	8-635	4 DB-603E	1,800	90'0"	.....	.....	72,600	.....	450	4,720	.....	Composite of 2 Do-335's
Junkers	Mistel 5	2 BMW-003	Jet	.....	.....	.....	.....	.....	500+	.....	.....	Composite of He-162 and warhead (designated Ju-268).
Junkers	EF-126	1 Argus Rohr propulsive duct	Jet	20'8"	.....	.....	6,160	.....	480*	.....	.....	Composite ground attack.
Junkers	FF-128	1 jet unit	Jet	30'2"	.....	.....	10,780	.....	590	.....	.....	Projected tailless jet fighter.
Kalkart	Ka-430	Glider	None	63'9"	.....	.....	.....	.....	.....	.....	.....	Glider.
Messerschmitt	Me-108	1 Argus	225	.....	.....	.....	.....	.....	180	540	.....	4 place personnel carrier.
Messerschmitt	Me-109G	1 DB-605D	2,000	32'6"	29'4"	12'0"	8,700	.....	428	350	37,800	Fighter-bomber.
Messerschmitt	Me-110G	2 DB-605B	1,475	53'4"	40'4"	13'1¼"	22,100	11,220	340	1,300	.....	Heavy fighter, bomber.
Messerschmitt	Me-163B	1 Walter liquid-rocket unit	Rocket	30'8"	19'5"	.....	9,500	.....	550	.....	50,000*	Interceptor.
Messerschmitt	Me-163C	2 Walter rockets	Rocket	32'3"	23'1"	.....	11,280	.....	590	.....	52,500[4]	Smaller jet for cruising.
Messerschmitt	Me-209	1 DB-603	(1)	.....	.....	.....	.....	.....	.....	.....	.....	Developed from Me-109.
Messerschmitt	Me-210	2 DB-605B	1,475	53'9"	40'4"	.....	21,350	.....	365	1,400*	28,500	Fighter, dive-bomber.
Messerschmitt	Me-261	2 DB-610	(5)	88'0"	54'7"	15'6"	.....	.....	.....	.....	.....	Like a scaled-up Me-110.
Messerschmitt	Me-262A	2 Jumo-004B	Jet	41'0"	34'9"	12'6"	15,600	10,000	530	.....	39,400	Fighter-bomber, recon.
Messerschmitt	Me-264	4 Jumo-211	(6)	141'0"	.....	.....	100,000*	.....	370*	7-9,000*	.....	2 jet units for bursts of speed.
Messerschmitt	Me-309	1 DB-603 or Jumo-213	(1), (6)	.....	.....	.....	.....	.....	.....	.....	.....	Experimental only.
Messerschmitt	Me-321	Transport glider	None	.....	.....	.....	.....	.....	.....	.....	.....	Towed by 3 Me-310's.
Messerschmitt	Me-323D	6 Gnome-Rhone 14N	1,200	180'0"	94'1"	24'0"*	99,000	61,700	136	.....	.....	Powered glider erroneously called "Merseburg Giant."
Messerschmitt	Me-410A	2 DB-603A	1,750	53'9"	39'10"	.....	23,500	13,500	390	.....	34,000	Development of Me-210.
Messerschmitt	Me-328B	2 AS-014 propulsive ducts	Jet	.....	.....	.....	.....	.....	.....	.....	.....	Mostly wood construction.
Siebel	Si-204D	2 Argus-411	600	69'9"	39'2"	14'0"	12,300	8,600	230	930	24,600	Communications, transport, trainer
Focke-Achgelis	Fa-223	1 BMW-323	1,000	.....	.....	.....	8,600	.....	.....	.....	.....	Helicopter, 2 large non-overlapping rotors.
Focke-Achgelis	Fa-284	2 BMW-801	(3)	.....	.....	.....	33,000	.....	.....	.....	.....	Helicopter, never completed.
Focke-Achgelis	Fa-330	None	None	.....	.....	.....	.....	.....	.....	.....	.....	Unpowered rotor kite.
Flettner	Fl-282	1 SH-14	150	.....	.....	.....	.....	.....	100	.....	15,000[4]	Helicopter, 2 opposite-turning rotors.
Flettner	Fl-339	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Helicopter in development.

*Approximately.

[1]DB-603's vary in take-off horsepower from 1,670 for the AA and AS models to 2,830 at sea level for the N model.

[2]DB-605's vary in take-off horsepower from 1,435 for the AS model to 2,700 at sea level for the L model.

[3]BMW-801's vary in take-off horsepower from 1,600 for the A,B,C, and L models to 2,270 at sea level for the TQ model.

[4]Absolute ceiling, not service ceiling.

[5]The DB-610 consists of two coupled DB-605's. The DB-610 A & B models have 2,950 take-off horsepower at sea level. DB-610C and D models have 2,870 takeoff horsepower at sea level.

[6]Jumo-213's vary in take-off horsepower from 1,750 for the E model to 2,600 at sea level for the J model.

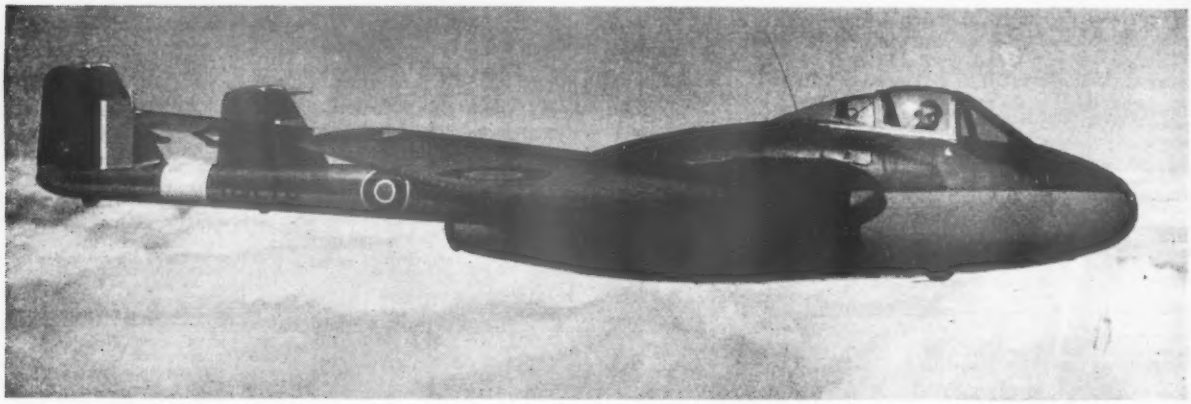
[7]Jumo-222's vary in take-off horsepower from 2,500 for the A and B models (series 1), to 3,000 at sea level for the C and D models.

[8]Jumo-211's vary in take-off horsepower from 960 for the A model to 1,500 for the N, P and Q models.

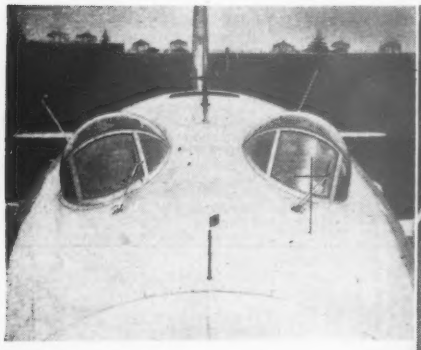
[9]Dis designation stands for Deutsche Forschungsanstalt fur Segelflug.

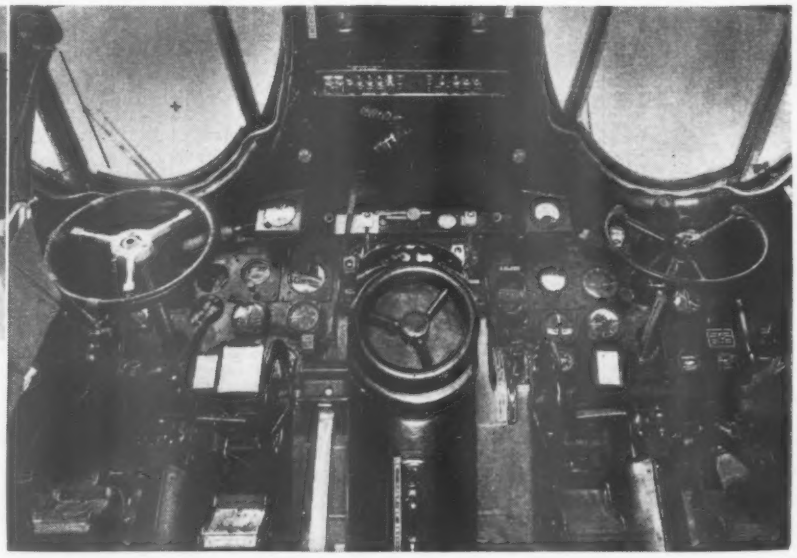
Have You Seen?

Largest British bomber is Avro Lincoln, direct descendant of famed Lancaster. It has four 1,750-h.p. Rolls Royce engines, top speed of 320 m.p.h. Wing span is 120 feet. It was to carry 11-ton bombs over Japan. Armament includes seven .50-cal. guns.

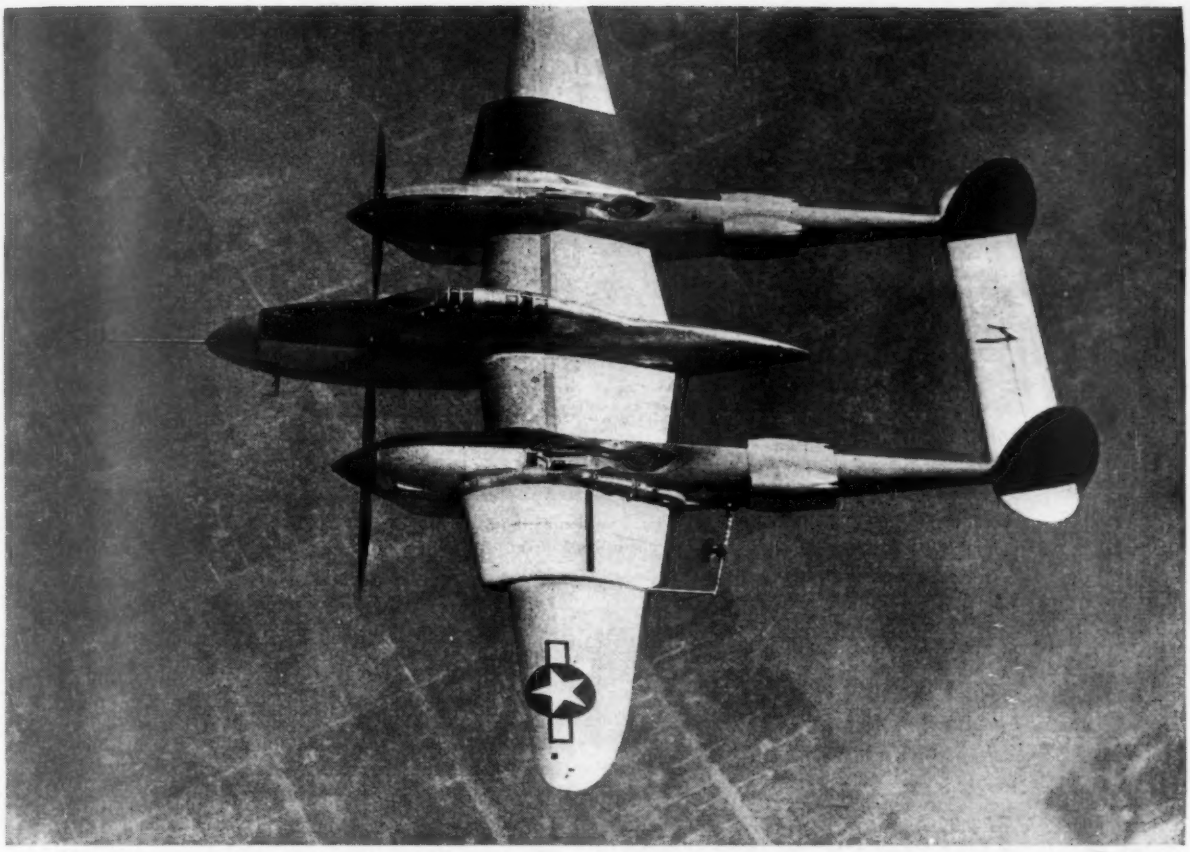


DeHavilland Vampire is reported to be world's fastest jet fighter. It has Goblin engine, is all-metal except for wooden, pressurized cockpit. Armament is four 20-mm. cannon. Vampire was first aircraft to exceed 500-m.p.h. in Britain or U.S. Ceiling is 50,000 ft.

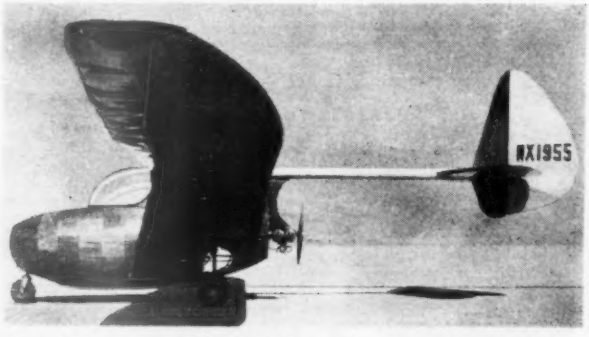




"Bug-eye" cockpit of Douglas Globemaster has individual hatches for pilots (above). Interior view shows bulges into which pilots' heads project. Control wheel at left is part of test equipment, will be replaced with standard unit in production models. Smaller wheels in center are for trimming ailerons, rudder and elevator.

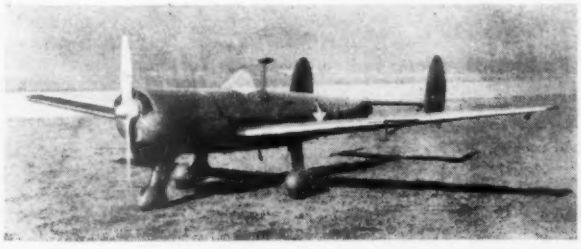


This Lightning fighter is used by Lockheed engineers to conduct high-speed flight tests of new airfoils, which are installed like sleeves over regular wing. Automatic instruments and camera in plane's nose record test data. Plane also carries an observer.



Bowlus-designed sailplane has 16-h.p. two-cycle engine, retractable gear. It climbs 300 f.p.m. to soaring altitude. Wing span is 47 feet.

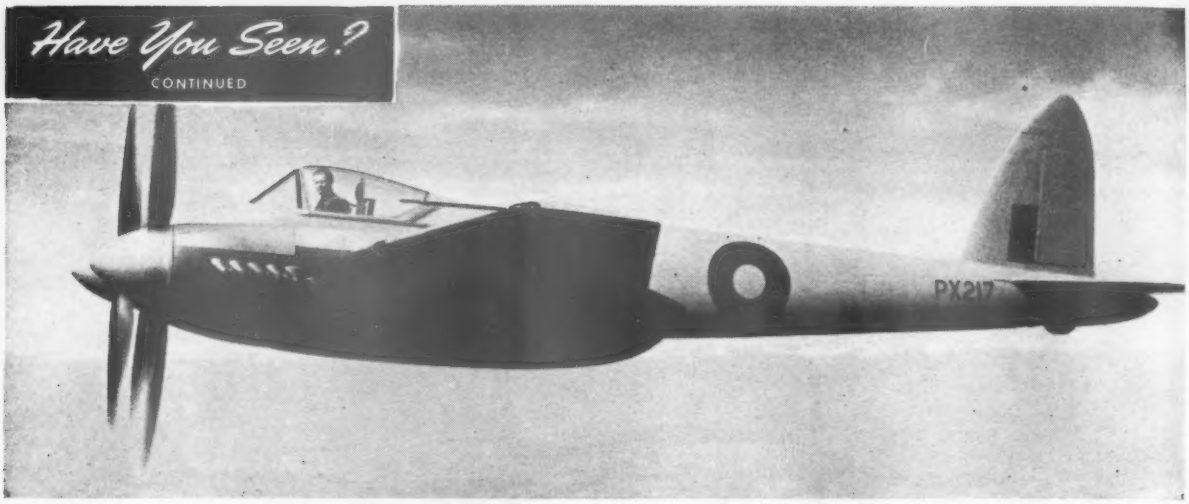
Douglas XB-42 is prototype of DC-8, successor to DC-3. It has two 1,725-h.p. Allison engines, pusher counter-props. Span is 110 ft. 2 in.



Experimental radio-controlled target plane is Fleetwings PQ-12. It was tested and discarded. It had air-cooled engine, tricycle gear.

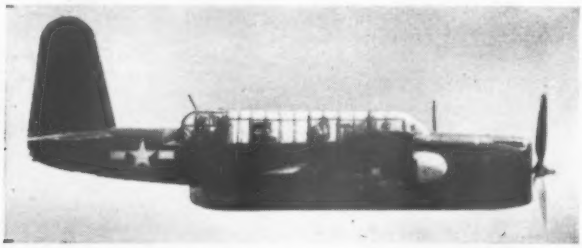
American soldiers found this Mustang which had been captured by the Germans, repainted and was later crash-landed during flight tests.

Have You Seen?
CONTINUED



Another new British fighter, the DeHavilland Hornet, is small version of the Mosquito, has two 2,070-h.p. engines, top speed over 470 m.p.h. Span is 45 feet, range 2,500 miles, rate of climb 4,500 f.p.m. Its armament is four 20 mm. cannon in the nose.

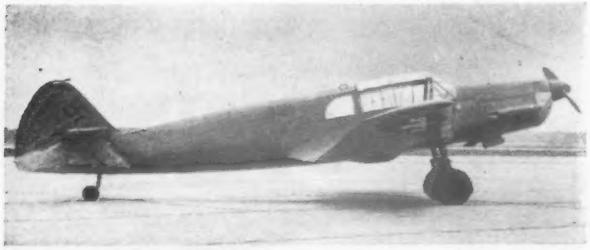
Vickers Viking is new British transport, has two 1,675-h.p. engines, cruises over 200 m.p.h. It carries 27 passengers. Span is 89 ft. 3 in.



Consolidated Seawolf (TBY-2) has 2,100-h.p. engine, cruising speed of 160 m.p.h. Range is 2,000 miles, gross weight is 17,491 pounds.

Curtiss XF14C was experimental Navy fighter, had 2,200-h.p. engine and counter-prop. Armament was four 20-mm. The type was discarded.

Night-fighter version of Lightning is P-38M. It has seat behind pilot for radar operator. Armament includes guns, rockets, bombs.



German sport plane is Messerschmitt Typhoon. Engine is 240 h.p., top speed 189 m.p.h. It is four-place. This one belongs to USAAF.

Experimental full-span flaps were tested on this XC-53 by the AAF. After preliminary flight tests on this airplane, idea was discarded.

I Learned About Flying From That!—No. 74

The author, shown in Boeing Kaydet, who made an almost-fatal mistake.

By JOHN GORDON BENNETT

When the weather man says "You'd better wait," it's better to trust his judgment than your own.

I HAD flown the few hundred-odd miles round trip between Rochester and Albany, N. Y. hundreds of times, and such checkpoints as Richfield Springs, Auburn and Seneca Falls were old friends. I frequently referred to the course as "my personal cowpath." One day a TWA captain riding with me remarked approvingly of my bee-line navigation. I replied quite casually that I could fly the course with my eyes closed —not meaning at the time to be prophetic.

It was in the spring of 1943, when civilian aircraft were not allowed to fly into the New York metropolitan area. Living in Rochester and having considerable business in New York City, it was my practice to fly my Stinson 105 to Albany, leave it there with Lee York of Albany Aircraft, and hop Colonial Airlines southbound shortly after 10 a.m.

On this particular day I was returning from New York. The weather at LaGuardia Field was poor, and until minutes before departure time it was touch and go whether Colonial's northbound flight would depart.

We did take off, however, and were immediately in the overcast. About 10 minutes later I was advised that it was questionable if we could land at Albany, that I might have to go on to Burlington. Sometime later the hostess handed me a second message; the captain would make one pass at Albany. One pass was enough. We broke out of the 800-foot ceiling just north of the field and in a matter of seconds were on the ground.

In the Albany weather station, my friend Peacock gave me my first encourging news. Buffalo, Rochester and Syracuse were practically CAVU, and Utica and Albany expected contact weather within an hour. Peacock was making an observation, and when he finished he shook his head in the affirmative.

"It's contact here now," he said, "Ceiling is 1,000 feet and visibility is three miles. Wait a minute and I'll check Ft. Plain and Utica."

I scanned the latest sequence—Buffalo and Rochester were okay, Utica had 1,500 feet, Fort Plain, 800. Peacock got the previous sequence and together we checked it over. Both Utica and Fort Plain had improved tremendously within the past hour.

"Fort Plain will be way up by the time I get there," I said, "I'm getting out of here." Peacock held up his hand. "Wait a minute," he said, "These things can be tricky. Let's wait and see if this improvement holds. It may go down. You'd better wait for another sequence."

I shook my head. "If it gets worse," I replied, "I can always turn around and come back."

Five minutes later I was helping Lee York push my Stinson out of a hangar. A quick visual check of gas and oil, and then Lee gave my engine a "prop." I revved up the engine, checked the mags, waved good-bye and started down the taxi-strip to the end of the runway where I gunned the throttle and eased the little plane into the air. A climbing turn to the left lined me up on a course just south of Schenectady. The air was turbulent and the ceiling noticeably low, but visibility was better than the three miles given me by Peacock.

At 2,400 r.p.m. the little 80-h.p. engine was running like a sewing machine. I settled back in the seat for the 2½-hour flight to Rochester. Suddenly, near Fort Plain, the visibility and ceiling dropped like a theater curtain. I spotted one hole where it appeared to be better than elsewhere and swung toward it. I looked behind me and the mist was right down in the trees.

In front, the ceiling and visibility were practically zero. Cautiously I turned to the left in a moderately steep bank. Beneath was nothing but forest. There wasn't a cleared space large enough to land a balsa-model plane, let alone my Stinson. Abruptly I was in the soup.

I immediately realized the spot I was on in my little "105" with its forlorn ballbank indicator on the instrument panel. Why, I asked myself, hadn't I been content to accept Peacock's advice and wait for the next sequence?

Frankly, I was petrified. I'd been in the overcast before many times, but never under these conditions nor this close to the ground. Suddenly my eye caught the airspeed and the ballbank indicator in one glance. The airspeed indicator was at 110 and the little ball was snug against the right corner.

At 110, my airspeed had picked up at least 20 m.p.h., and I guessed that I was in a steep spiral. I dropped my left wing until the ball was back in the center and wound back slowly on the stabilizer. Gradually the airspeed dropped to 105, then 100, and finally to 90. I increased the throttle and wound the stabilizer back still more. Now the airspeed was 85, and the compass was whirling madly.

I should be climbing, I thought, and looked at the altimeter which was creeping up slowly. Two thousand feet, twenty-one hundred. Would I ever get on top? Would I hit something? The compass was still whirling, but I didn't care. The only thing I cared about right then was that the fan out in front keep turning, and that I gain altitude. I turned on manifold heat and the r.p.m.'s dropped off, so I brought them up with more throttle. Now I was at 4,000 feet and still in the soup.

Finally, at 4,500 feet I broke out right

(*Continued on page* 124)

Letters

Reader comments should be addressed to Letters Editor, FLYING, 185 N. Wabash Avenue, Chicago 1, Illinois. All letters should be signed. Names withheld upon request.

LANDINGS—STALL OR WHEEL?

I don't believe anyone who has watched Navy or Marine pilots *attempt* to land will give much credence to the criticism of "two Marine pilots" anent Hoyt's article "Is the Stall Landing Obsolete?" (FLYING's September issue.)

The usual Navy landing consists of bringing the plane down to a full stall at the peel-off and finally making a "controlled crash" on the runway.

I fully agree with Hoyt on use of throttle. I have gotten past the point where I desire to show off by trying to make a power-off landing on the end of the runway.

As for my own qualifications, I've been flying since I was 12, am a fighter pilot, and have been checked out in 23 different types of aircraft.

AIR CORPS CAPTAIN

Tampa, Fla.

● Readers should also see pages 30 and 31 of this issue.—ED.

AIR WAR TEACHER

I noted with interest Max Karant's article "What Did the Air War Teach Us?" in FLYING's October issue.

It was our squadron that first spotted the motor convoy shown destroyed in the picture on page 22 of this issue. Here's how it happened.

Before dawn our squadron, led by Maj. Thomas Personnette, trapped the convoy in the ravine and radioed for the other two squadrons in our group as well as another fighter-bomber outfit. We had a tough target, as evidenced by the high hills in the background, and the narrow road that twisted around was high on both sides.

We hit the target with everything our *Thunderbolts* had—rockets, demolition bombs and plenty of .50-caliber armor-piercing slugs.

It took us two days to finish the job. We later had the pleasure of driving over the same road and found the pavement pock-marked from our machine-gun fire.

LIEUT. STUART MOAK

Brooklyn, N. Y.

HOW'D HE DO IT?

James C. Ritter, in his "I learned About Flying From That!" article in FLYING's October issue turns a neat trick.

In the beginning he is in the front cockpit, watching his student in the mirror. Later on, he is glaring at the student's back. How did he change cockpits in mid-air?

LIEUT. RAY W. ZURCHER

Roswell, N. M.

We wonder how Ritter is still alive after his experience. Furthermore, we disagree with his method of recovering from a stall-out turn, for all one has to do is apply throttle, shove the stick forward and complete the turn. Or does he like to kick top rudder and do half-snap rolls at 500 feet?

LIEUTS. ALLEN WARFIELD, HANK SOKOLOWSKI, WILLIAM KATER, BILL BROWN, LEON ADELMAN.

Greenville, S. C.

● Paging Mr. Ritter!—ED.

COLLEGE COUNSEL

I read with great interest Paul Fountain's article, "Aviation Goes to College," in the October issue of FLYING.

My son wants a bachelor's degree in air transportation and this article was the first information I have been able to secure regarding colleges offering this training.

Can you provide any further aid in determining which schools would also offer a degree in aeronautical engineering?

MRS. PHILIP FARNSWORTH

Dover, N. J.

● A booklet, "A Survey of Collegiate Courses in Aviation and Related Fields," prepared by the American Council on Education in 1944 is available through the CAA. Washington, D. C.—ED.

BUYING A SURPLUS FIGHTER

Since I travel extensively, and with time an important element, it occurred to me that acquisition of a surplus fighter plane might be the answer.

If a surplus P-40C could be bought for $4,000 or $5,000, its 6,700-pound weight reduced to about 5,000 pounds by stripping all military appurtenances, a pilot could cruise at 50 per cent throttle, or 500 h.p., at a speed of about 300 m.p.h. Gasoline consumption would be about 58 gallons per hour.

Standard commercial private planes of 150 h.p., cruise at about 100 m.p.h., and at 75-80 per cent throttle consume 15 gallons of fuel per hour. On a hypothetical trip of 300 miles, the surplus fighter's time would be one hour and the private plane three hours. The fuel difference is negligible compared to time saved.

If the converted fighter received normal maintenance, such bills would compare favorably with the commercial plane.

BUSINESSMAN-PILOT

Williston Park, N. Y.

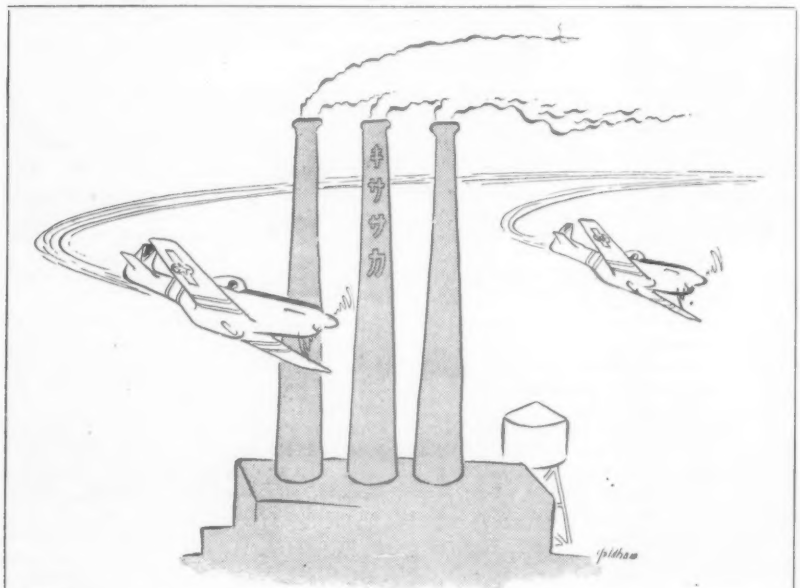
● Statistics gathered by FLYING's editors indicate purchase and operation of a surplus fighter would be a costly project.

North American Aviation advises that this reader's performance calculations are fairly accurate, but his maintenance theories are way off.

One *Mustang*, flown only 18 hours in one month, ran up a total repair and maintenance cost of $2,000, not including parts for that period.

One surplus *Lightning* fighter purchased by Arthur D. Knapp, president of Mechanical Products, Inc., for business purposes, has the following record: Initial cost, about $10,000; modifications for CAA certification, $2,000; gasoline per hour, $26.60; oil per hour, $2.12; maintenance and periodic checks, $5 per hour; insurance, $6 per hour; depreciation $12 per hour. Tax and hangar fees are additional.—ED.

END



FLYING

"Red Leader One to Red Two—'Bread an' butter'—over."

There's More than a Plane in this Picture!

SON: Look, Dad! This lower cowl line lets you see the ground from the pilot's seat, even after the plane has landed!

FATHER: So I've noticed—and did you see these big doors on both sides of the Aeronca Chief's cabin, and the room there is inside?

MOTHER: I like the looks of this plane... it's definitely *smart* . . . and the price certainly is reasonable!

DEALER: You're all on the track, but there's more than a plane in this picture! Aeronca is one company that has a *plan* as well as a complete line of personal planes. For a long time they've been promoting the idea of airstrips everywhere, so people can fly their own planes anywhere.

• • •

And Aeronca's picking its dealers the same way—all over the country. I'm proud to be one of them, because to be one you've got to deliver service and know your business. There's a booklet you can get by sending 10¢ to Aeronca Aircraft Corp., Dept. F-1, Middletown, Ohio. It's called "Aeronca, the Plane You'll Want to Fly," and tells all.

• • •

(Export Agency—Aviquipo, Inc., 25 Beaver St., New York 4, N. Y.)

AMERICA'S PERSONAL PLANE

AERONCA has an important message for air-minded people

AOPA NEWS

The Aircraft Owners and Pilots Association (AOPA), with National Headquarters Office located in the International Bldg., 1319 F Street, Washington 4, D. C., is a non-profit organization composed exclusively of pilots. It looks after the pilot's best interests in all phases of aviation and helps individual pilots with their individual problems. The AOPA operates with a full-time professional staff and is the largest group of civilian pilots in the world. This column is edited by the Aircraft Owners and Pilots Association and opinions contained in it are not necessarily those of FLYING. A special bulletin is sent each month to all registered AOPA pilots and also confidential newsletters from AOPA's Washington staff are sent members from time to time

OUR NEW PLANES

A wave of disappointment accompanied a recent announcement of new private plane performance data and cost price. The performance figures were lower than expected and the prices higher.

Many pilots had tongues-in-cheek when reading wartime advertising about "family aircraft," $1,000 airplanes and such, but the majority of expectant purchasers—mostly newcomers in aviation—believed what they read and now are disappointed.

With few exceptions they complain that 1945 personal airplanes are not "family aircraft," but merely 1941 airplanes with new paint jobs, a few minor refinements, and higher price tags.

The pre-war lightplane manufacturers' new production models, according to our information, will start slightly over $2,000 for two-place aircraft, and four-place aircraft priced upwards from $4,000. Prior to the war, two-place airplanes started at around $1,200 and four-place airplanes were scaled from $3,800 upwards.

Increased costs of personal aircraft follow increased costs in other products. Manufacturers' costs of materials, labor, and management are all up and may stay up for quite some time. It is unfortunate, from the prospective plane owner's viewpoint, and is bound to revise speculated sales figures downward. Early introduction of attractively low down-payments on long-term installment-purchase contracts may ease this situation, and many new finance companies will probably tumble pre-war time payment plans and force lower interest payment, service and insurance schedules. Returning vets will find loans under the GI Bill of Rights helpful if purchase of aircraft is made for business purposes.

While a rise of cost must, in the final analysis, be reluctantly labelled as inevitable, *stagnation of design* was not expected and there appears to be less reason, if any, for this disappointment. Manufacturers were, of course, anxious to get a marketable product off their production lines at the earliest date. There was a current demand for airplanes; *any* airplane that would fill the requirement of the fixed-base operators who were enjoying an unprecedented spurt of business following termination of war restrictions. Indeed, the average operator could make money with a 1935 airplane if it were in the minimum necessary airworthy condition.

THE FORGOTTEN MAN

The forgotten man in this first rush of personal aircraft production is the personal aircraft owner. His needs and requirements which provided the eye appeal in most advertising are evidently lost. Perhaps they should be—stabilization of fixed-base operations may be of first importance in order to provide better landing facilities for personal aircraft owners.

Manufacturers, however, must recognize that this reasoning is not understood by many of their prospective customers, that there is a need for explaining honestly and in detail what the *actual* prospects for "family aircraft" are, how soon, how much, and what design improvements will be introduced.

It is natural that competition will accelerate design improvements, and that individual manufacturers will not be prone to move faster than required by consumer demands or to meet competition. It also is probable that manufacturers have many "secrets" on their drafting boards which will be announced some time later, just prior to actual production and sale.

CHANGES TO BE FORCED?

Our discussions with individual manufacturers would indicate that constant prodding may be necessary to bring about necessary *major* design improvements. North American's entry into the personal aircraft manufacturing group may prove as much of a bombshell as that caused by Republic's *Seabee*. Old-time manufacturers may thus be forced to step up their plans for *new* airplanes and to discard many pre-war designs. There are strong indications of other large producers entering the personal airplane manufacturing field. They will be starting from scratch in their design and plant tooling. With almost limitless financial resources, they may be in a position to introduce revolutionary new designs. Much of this is speculation, but there are definite hints that the personal aircraft owner's aspirations may be achieved by the entry of new manufacturers.

Can old-time manufacturers meet this challenge? Of course, only time can tell which of the popular brand names will remain. Remember the Stutz, the White, the Erskine, and Reo, to mention a few? These are "lost" names in the automobile world. It will be a tough race and the survivors, we suspect, will be those who stress advanced design and, particularly, major advances in safety design.

Research organizations whose facilities are available to manufacturers advise AOPA that the industry has been slow in accepting proven safety features and that this lag accounts for some of their reluctance to spend further efforts and funds for private plane research.

STANDARDIZATION NEEDED

While each manufacturer has individual problems revolving around the proposition of building a better and more saleable airplane than his competitor, there is an important phase of standardization which has been entirely overlooked to date. We refer to such matters as standard cockpit arrangement, including positioning of major control elements, standard types and numbers of instruments which are included as *minimum* equipment.

Standardization is more than a matter of convenience. It is very important to safety. "Cockpit familiarization" probably will always be a prerequisite in transferring from one airplane to another, but the maze of differences existing between similar airplanes of different makes is too great. *It can be simplified* if manufacturers through their appropriate trade organizations, will sit down and agree to certain definite principles.

Placement of various controls and gadgets has, for the better part, been determined without any reference to convenience or standardization. Valves and control handles frequently are placed out of reach of the pilot unless the safety belt is released. In one airplane the stabilizer control turns by an overhead crank. In the next, a wheel control on the side provides this adjustment. Fuel valves can be found almost anywhere near inaccessible corners but never in the same corners. In some aircraft you push levers down, in others sideways, and still others upwards, or a combination of all these.

Manufacturers should stop this nonsense before they are regulated into doing so. An "in-flight" position for all controls should be agreed upon. This might call for throttle control, propeller-pitch control, landing-gear control, cowl flap control, etc., *all* in a forward position.

MINIMUM EQUIPMENT

In the old days, as many AOPA pilots will recall, the price tag on an automobile did not include many accessories, such as bumpers, spare tire, trunk, etc. One purchased a car and then purchased these required accessories. And so with many planes today . . . an extra charge for brakes, for a cabin heater, for radio, etc.

We do not necessarily contend that *all* of the foregoing should be included in standard equipment, but we do feel that *standard equipment* should be established in accordance with minimum requirements, possibly in two categories: (1) for CFR flight, including night; (2) for instrument flight. END

"My War Job's Done.. SO HERE I COME!"

NEW Mobilgas AIRCRAFT GIVES FLYING HORSEPOWER

Mobilgas AIRCRAFT

IT'S HERE *for all planes*—the same super power that boosted U. S. fighter-bomber performance—in a great *new* Mobilgas Aircraft!

It's *Flying Horsepower*—a new kind of gasoline performance that gives commercial and private planes faster take-offs, climbs, speeds.

Flying Horsepower climaxes 13 years of Socony-Vacuum research—is the result of world's greatest catalytic cracking program.

Get NEW Mobilgas Aircraft and you get the greatest flight power you've ever known . . . *Flying Horsepower!*

SOCONY-VACUUM OIL CO., INC., 26 Broadway, New York 4, N. Y., and Affiliates: Magnolia Petroleum Co., General Petroleum Corp. of California

TUNE IN "INFORMATION PLEASE"—MONDAY EVENINGS, 9:30 E.S.T.—NBC

THE LIBRARY

THE STANDARD GUIDE TO PRIVATE PLANES, by Lester Ott; published by Aeronautics Publishing Associates, 501 Fifth Avenue, New York, in 1945. 128 pages. Price $2.

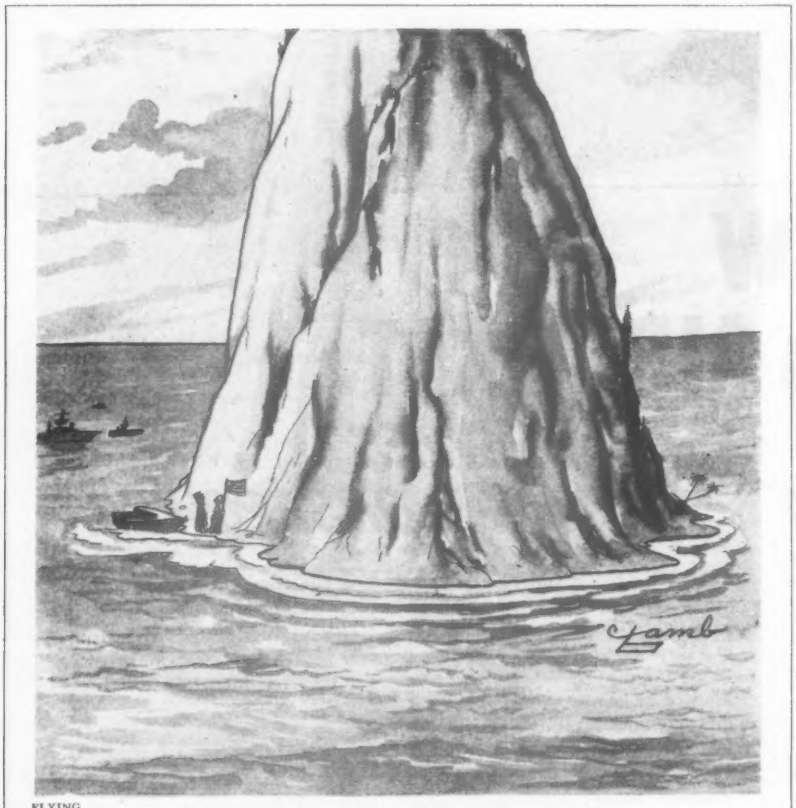
This paper-covered book printed on slick stock in standard magazine size contains ads, information on what to look for in buying a plane, and lists of personal aircraft, rotary wing aircraft, gliders and sailplanes and aircraft engines. It also has some basic data on insurance, financing, basic flying regulations and elementary flight instruction.

The book's main purpose, however, is to present specifications, information, photographs and prices of currently manufactured personal aircraft. In this it fails considerably, not only because the author has made poor selections in some cases and has faulty information in others, but primarily because the book's publication is premature. Of course there never would be a time when models have sufficiently jelled that some parts of a new book on the subject would not be out of date, but in this case hardly any manufacturers have made sufficient information available on their new models to make a book very worthwhile.

It is inaccurate, for example, to list the Beechcraft 18S (cost $55,000 or thereabouts) as a "personal aircraft," and even worse to picture an experimental butterfly wing model. In almost every listing mistakes and "padding" can be found because, in the publisher's effort to hit the market while it is "hot," he has hit it before the iron has even been put in the fire.

It is misleading to list models like the Stout *Skycar* with its Spratt controllable wing. Though that model is in reality in early experimental stage, Consolidated Vultee has no plans to put the plane into production so far as is known. No plans have been indicated that Howard Aircraft plans to manufacture the pre-war DGA, and the Stearman-Hammond—built 10 years ago—will never be built again in the form shown. On the whole, however, the errors of commmission in this book are insignificant compared with those of omission. The manufacturers simply have not been ready for it.

CURTIS FULLER



FLYING

"You can call your Seabees down off the hill, Lieutenant. We won't need an airstrip here after all."

WINGS ACROSS THE WORLD, by Hugh B. Cave; published by Dodd, Mead & Co., 432 Fourth Avenue, New York, in 1945. 175 pages. Price $2.50.

This story of the Air Transport Command sketchily covers what was probably one of the most amazingly efficient of all war operations. In the attempt to avoid use of statistical matter—total route miles, number of planes in operation, miles flown each day—the author has weakened his over-all picture of the ATC.

To compensate, the author devotes a part of each chapter to actual incidents that portray the individual sacrifices and accomplishments of ATC pilots and crewmen—an effort which lends considerable color to his book.

Briefly, Mr. Cave's ATC story is easy to read and is well illustrated with pertinent pictures. By treating the divisions of the ATC separately, the author has given a very generalized picture of the world-wide routes flown and the types of aircraft employed, with the ever-present personality sketch to color the account.

Even the Naval Air Transport Service has been given a chapter which thinly indicates its share in our global air-transport system. An abbreviated appendix lists the type of planes used by both Army and Navy in air transport.

LAWRENCE KEIL

WOMEN IN AVIATION, by Betty Peckham; published by Thomas Nelson & Sons, 385 Madison Avenue, New York, in 1945. 164 pages. Price $2.50.

Here is a fairly accurate summarization of the part women played in aviation during World War II—plus a more or less hopeful description of the new positions which will be open to women in post-war aviation.

In the first of the book's two main divisions, the author lists the hundreds of tasks done by women in the military services—Wasp, Wac, Waves, Spars, Marines, flying nurses, Civil Air Patrol—and describes their qualifications, training, duties, and experiences. Factual information is interwoven with interesting personality sketches. Miss Peckham skilfully retains the glamor of wartime aviation while describing the hard work, long hours and the often unfavorable living conditions.

The second part of the book describes the work done by women in aircraft manufacture. The author enumerates the positions available, qualifications, duties, and gives a picture of life at the plant. Other chapters tell the story of sky hostesses, women meteorologists, Government girls, women instructors and trainers.

Miss Peckham also discusses the future for women in aviation. She has combed the field of job possibilities and has presented an excellent vocational summary in a concise and interesting manner. However, her prognostications do seem a bit optimistic. She believes, for instance, that all youngsters will learn to fly, that pilot's licenses will be given out with high school diplomas and that children will argue over the use of the family plane as fervently as they formerly did over the family car.

GRACE HICKOK

Combined for the first time

JET + PROPELLER

Doing the "Can't Be Done" in { Climb / Maneuverability / Speed

THE NEED: A *carrier-based* combat plane combining the advantages of jet propulsion for peak performance... plus piston-engine and propeller power for short take-off and long range.

THE EXPERTS said "it can't be done." But the Navy and Ryan, working together, tackled the problem and *licked* it... in the *first design.*

THE RESULT: The most successful application of jet propulsion yet worked out.

- The only jet plane which can operate from aircraft carriers.
- New high performance – superior maneuverability, speed and climb – over widest range of altitudes.
- Best combination of desirable fighter characteristics, each with its relative degree of importance to the others.
- Tremendous emergency power when both engines are used together.
- Advantages of two-engine airplane in single-engine configuration.
- A plane which gives pilot combat advantage at all times.

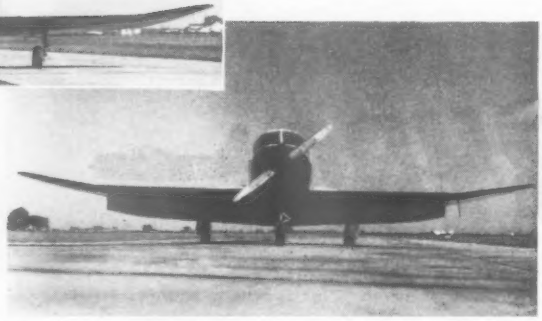
RYAN AERONAUTICAL COMPANY • SAN DIEGO

Fireball RYAN Fighter

U. S. NAVY'S NEW JET PLANE

CULVER WAS

This headon view of the new Culver Model V shows the upturned wing tips which add so much to its stability and ease of flying. Evident too are the unusually clean lines that make it the fastest light ship in the world for its horsepower.



Clearly shown here is the unusually large flap of the new Culver Model V . . . partly responsible for easy flying and unspinable characteristics of the latest of the Culver line. Also clearly shown is the sturdy, tricycle gear which makes ground handling as easy as driving an automobile.

Culver has tried to be conservative in its advertising, limiting its statements to generalities and the phrase that the new Culver "V" Model would be "worth waiting for."

That new Model "V" has been undergoing test flights at the factory since September and now we feel the story can honestly be told. It is the only airplane to introduce the new Mooney SIMPLI-FLY* Control, which makes flying simple and safe . . . so simple, as a matter of fact, that the Culver becomes the airplane pilots will enjoy but a grandmother can fly. SIMPLI-FLY Control entails the basic interconnection of wing flaps with the stabilizer, together with a flight control dial indicating to the pilot the

optimum settings to obtain the best performance of the airplane, and at such setting the airplane will, inherently, tend to trim for optimum performance, thus greatly reducing the hazards from the art of flying and allowing the novice and experienced pilot alike to fly safely and simply.

In other words, set the dial for "take-off" or low gear, advance the throttle and the ship takes off. Throw the dial in second gear or "climb" and the airplane climbs at optimum. Put it in high, or set the dial for "cruise" and the airplane levels out at cruising. The landing is just as simple.

There are many other innovations and features such as: tricycle electrically retractable gear with auxiliary manual control; low wing design; controllable pitch propeller; fuel injection to eliminate carburetor icing, bigger wheels, in excess of 700 miles cruising range, individually adjustable air-foam seats, beautiful interior; not to mention that the new CULVER IS STILL THE WORLD'S FASTEST LIGHT AIRPLANE FOR A GIVEN HORSEPOWER.

All of this didn't just happen. It has required months and years of experiment. And what might seem like an entirely new airplane to the public becomes an old story to Culver for it is the culmination of concentrated design experience on Army and Navy radio controlled airplanes on which Culver has been the sole supplier to the government during the war. In other words, heredity has played its part in the development of the only new land plane to be introduced by any airplane manufacturer so far postwar.

If the airplane that is in your plans does not include the safety and design features of the new Culver Model "V" it might be a new, but an already obsolete aircraft.

So may we humbly suggest, before you buy, that you let one of our dealers tell you about the new Culver Model "V." Or if you prefer, a request to the factory will bring you a fully illustrated color brochure explaining and describing the only absolutely new airplane on the market which is years ahead of its time. And you'll agree with us, IT WAS WORTH WAITING FOR.

*Trademark

worth waiting for!

The new Culver Model "V" meets the Dear Departed Friend.

Wing Span	29′
Length (Overall)	20-6
Height (Rudder)	6-9½
Propeller Ground Clearance (Average)	7′
Stabilizer Span	9-2
Wing Dihedral 2°-40′ Tip	10°
Wing Area including Flap Area	125.9
Landing Gear Tread	8′-1½″
Main Gear Tire Size	600 x 6
Nose Gear Tire Size	500 x 4
Cabin Width (Inside)	40″
Baggage Capacity (Forward)	60 lbs.
Duffle Capacity (Rear)	20 lbs.
Gas Capacity	35 gals.
Cruising Range in Excess of	720 miles

Cruising Speed..Faster than the Old Culver*
Continental 85 HP Fuel Injection Engine
Useful Load..681 lbs.

**Culver does not wish to quote definite performance figures until certified by the Civil Aeronautics Administration.*

FOR THE LATEST INFORMATION WRITE CULVER AIRCRAFT CORP., DEPT. FL, WICHITA I, KANS.

It's CULVER FOR CROSS COUNTRY

CULVER DEALERS SAY

. . . after a demonstration at the factory:

"We expected something evolutionary but nothing so revolutionary." Ken Hockensmith and Rege Ott; Pacific Skycraft Co., Inc., 722 SW 18th,. Portland 5, Oregon. Serving Washington and Oregon.

"M-m-m-m-m-m-m-m. Swell!" Otis Edgerton; SouthernAire Sales and Service, Municipal Airport, Alexandria, Louisiana. Serving Louisiana, Mississippi and southern Arkansas.

"Greatest improvement in aviation in the last decade." Harry Royster and E. G. (Slim) Kidwell, Standard Aircraft Co., Central Airport, 13610 South Central Avenue, Los Angeles 2, California. Serving Southern California.

"This is the airplane that makes your annual trip a weekend jaunt." Judson G. Sherrill; Sherrillaire, Inc., Northfield Airport, Richmond, Virginia. Serving Virginia and the District of Columbia.

"Culver's still way ahead of the industry." Paul L. Cromelin; Augusta, Georgia. Serving Georgia, Western North Carolina and South Carolina.

"We're in business . . . we're in business . . . we're in business." J. W. Marshall; Gulf Aeronautics, Municipal Airport, Beaumont, Texas. Serving Texas.

"A new day for aviation. Wait 'til the business man sees this!" Alton H. Walker; Walker Aircraft Sales, Monterey Peninsula Airport, Monterey, California. Serving northern California.

"A mighty fine airplane. Just the thing we've been waiting for." Jerry Francis and Howard Angell; Advanced Aviation Association, Capital City Airport, Lansing, Michigan. Serving Michigan.

"Culver was five years ahead in 1941, and the new model puts Culver ten years ahead. America's airplane." I. W. Baldwin and Gordon Diver; Civilian Aircraft Inc., Lincoln Bank Tower, Fort Wayne, Indiana. Serving Indiana.

Ports for the Private Plane: New York City

(*Continued from page 42*)

by one part-time and seven full-time instructors to handle 800 active students, according to the operators. Flight fees are based on aircraft horsepower, planes of 80 h.p. or less are $12 dual, $9 solo hourly, planes over 175 h.p. are $15 and $12, dual and solo respectively, and aircraft in the 220-330-h.p. range are $21 dual and $18 solo per hour.

Lightplanes may be hangared here at $30 per month, $1.50 overnight. Planes in the Stinson 105 class bring a monthly rental of $50; overnight, $3. Larger planes are tagged with a monthly rental of $75, with a $5 overnight charge. Storage for a plane the size of a Lockheed *Lodestar* is quoted at $125 monthly or $10 overnight. Tie-down charges are the same, regardless of the plane size or horsepower: $15 monthly, 50 cents overnight.

Formerly known as Bendix Airport, the field comprises 400 acres of sod, with four sod runways which, the operators state, will be extended to 4,500 feet this spring. FLYING was advised that plans have been approved for the construction of 200 T-hangars, which will sell for $2,500 and up, each. It was also claimed that future plans include an expenditure of $2,000,000 by Standard Oil of New Jersey to develop this field.

If such plans materialize, this air terminal, with its favorable inland location with excellent approaches and general freedom from fog has the greatest possibilities for developing into the best private plane airport in the Manhattan vicinity. Its location, 13 miles from midtown Manhattan, two miles from Hackensack, N. J., off U. S. Route 46 via the George Washington Bridge, provides fairly fast transportation to the downtown area. Buses on N. J. Route 6 (two blocks from the office) may be taken to midtown at 41st Street and 7th Avenue, from where rapid service downtown via the Hudson tubes is available.

Pilots stopping overnight at this field may obtain rooms at either the Alexander Hamilton Hotel in Paterson, six miles from the field, or the YMCA in Hackensack. Within a quarter-mile of the field are three restaurants and two diners, providing adequate eating facilities.

LITTLE FERRY, N. J. seaplane base, 11 miles from Manhattan, two miles from Hackensack is situated favorably on the Hackensack River, one-half mile from N. J. route 6 and U. S. route 46. It provides the same transportation as that from the Teterboro Air Terminal.

Here North American Flying Service, operated by Anthony A. Barrone, has 200 students, two full-time and three part-time instructors for the four Aeronca seaplanes. Dual instruction here is $10 per hour, solo $8. No hangaring costs could be obtained here, since no tenants or transients have been stored in the 50 by 60 foot hangar on shore. Future plans were outlined for two hangars, each 100 by 100 feet (construction scheduled for this spring), plus an administration building and recreation lounge.

ON STATEN ISLAND, N. Y., FLYING visited the Staten Island airport and observed the services and facilities of the fixed-base operator, Skyservice. Here nine planes, including *Cubs*, an Aeronca, Fleet, Stinson *Voyager* and Waco UPF-7, were used by 150 regular students. The staff of three regular instructors was augmented on week-ends by part-time instructors.

The main 1,800-foot north-south and east-west runways, along with the 2,600-foot northeast-southwest runway on the 140-acre field are scheduled to be lengthened to 4,000 feet in the near future. Located 15 miles from South Ferry, N. Y., transportation to the downtown area takes about an hour. Buses, on the highway adjoining the airport, connect with trains at the Eltingville station which take 15 minutes to arrive at the St. George ferry terminal. The boat ride from there to New York takes 20 minutes. There are no restaurants or overnight-stopping facilities for pilots in the neighborhood of the field.

Plane rentals are about the same as at other fields: $10 dual, $8 solo hourly for *Cubs* and the Aeronca. The Stinson and Fleet rent for $12 and $10, dual and solo, with larger planes (PT-19), $18 dual, $15 solo per hour. There are no tie-down provisions.

At MOUNTAIN VIEW, N. J., Murchio Field, is farther out from downtown Manhattan than the fields discussed up to this point. Rates are somewhat lower: $10 dual and $7 solo for the four *Cubs* owned by Thomas A. Murchio, fixed-base operator. Hangar rental for these is $25 per month, $1 overnight. Stinson hangarage is $30 monthly, $1.50 per night for transients. Larger planes bring $35 per month in rental, with the overnight fee also $1.50. Tie-down for all planes is $20 per month, with overnight fees 50 cents for lightplanes and 75 cents for all others. Eight privately owned planes are based here.

One full-time instructor—who is a certified flight-examiner—and four part-time instructors are available for the 45 regular students on this operator's books.

Murchio Field is situated seven miles northwest of Paterson, N. J., and 23 miles from Manhattan's center. The trip to New York requires a full hour via Mountain View or Pompton Lakes buses on N. J. Route 6 to Paterson, and railroad or bus from there to New York. Sleeping accommodations for pilots stopping overnight can be obtained no nearer than the Alexander Hamilton Hotel in Paterson.

WHITE PLAINS, N. Y., Westchester County Airport is, in some respects, undoubtedly the "show-place" of the bases visited. In other ways, it is probably the most inconvenient—the entire lack of public transportation and the absence of any hangaring facilities make its glamor fade appreciably. Transportation from White Plains, nine miles away, to the field must be made by private car or cab. From White Plains to New York's business district only trains are available, with the

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And the new ***Swift*** gives you ***everything*** it takes to make your ***business*** flying profitable. It's *all-metal* . . . sturdy, weather-proof, easy to maintain. It has plenty of power and rugged stability for flying in any weather thats safe for *any* airplane. It's simple and easy to control . . . restful to fly, and there is plenty of speed, power, and range for safe, easy cross-country travel.

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Be one of the fortunate 4,000 who will own a new ***Swift*** in 1946. Place your order with your ***Swift*** Dealer NOW. AIRMAIL . . . the coupon TODAY!

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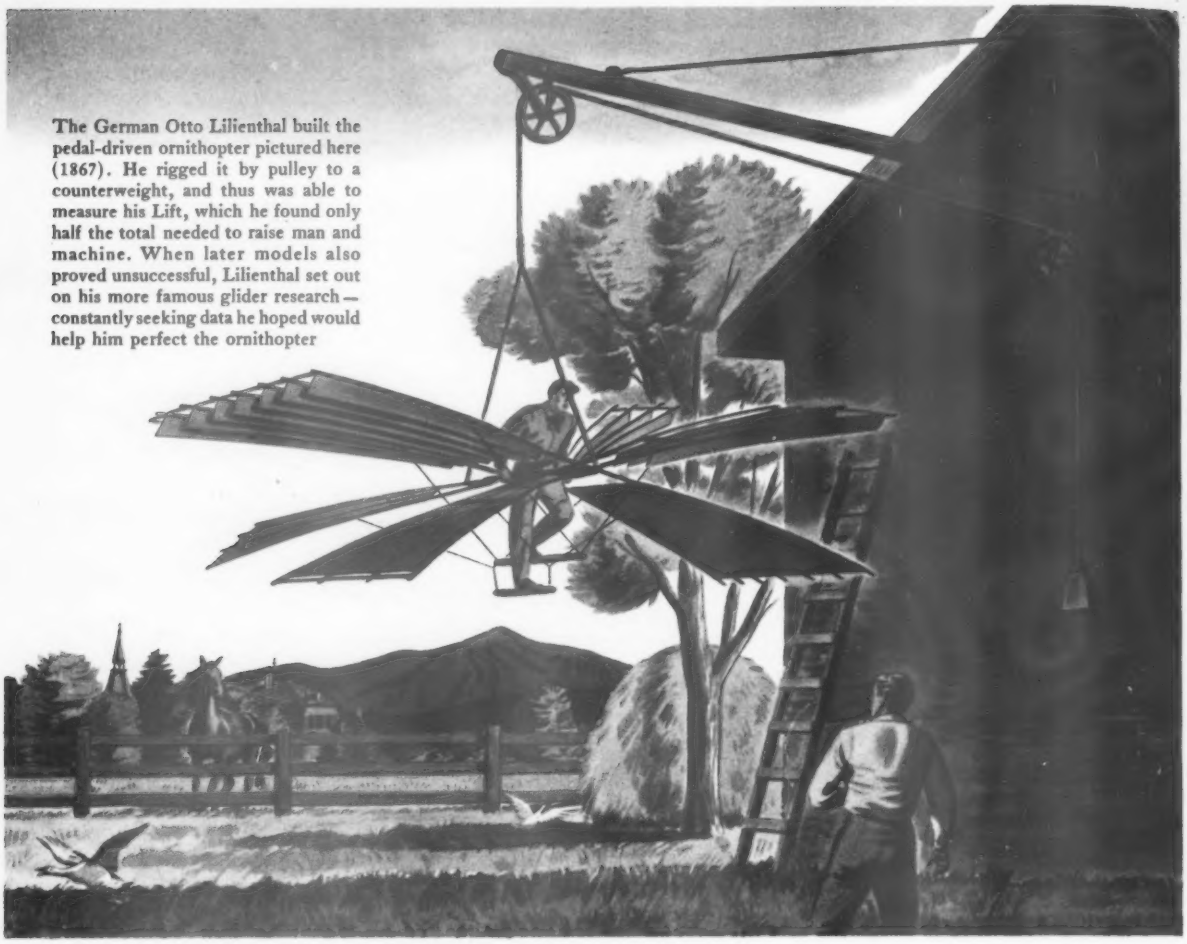


The German Otto Lilienthal built the pedal-driven ornithopter pictured here (1867). He rigged it by pulley to a counterweight, and thus was able to measure his Lift, which he found only half the total needed to raise man and machine. When later models also proved unsuccessful, Lilienthal set out on his more famous glider research — constantly seeking data he hoped would help him perfect the ornithopter

In a barnyard, LILIENTHAL LEARNED HOW TO MEASURE THE *LIFT* OF WINGS

In aviation there is a battle not yet finished. It is man's struggle to increase the useful force of air around a wing, and to reduce the friction of air against a plane's surfaces. It is the continuing battle of *Lift* versus *Drag.*

During the past twenty years, the victories in this battle have been many, a notable number scored by Northrop. Toward Drag-reduction, for example, Northrop pioneered the monocoque fuselage in 1927. Multicellular, internally-braced wings and wing fillets for monoplanes came from Northrop in 1929. And, in 1932, Northrop introduced the first split flaps to increase Lift in take-offs and landings.

The years 1935 to 1941 brought other Northrop advancements: The first double-split dive flaps . . . heliarc welding of magnesium for lighter, smoother construction . . . the first retractable ailerons. And the first successful all-wing airplane, the Northrop *Flying Wing,* which housed everything inside the wing.

What next in the battle of Lift versus Drag? Many of the answers will come from Northrop, from plans already set to create both more efficient propulsion and planes of still more advanced design. Northrop Aircraft, Inc., Northrop Field, Hawthorne, Calif.

ARMY (E) NAVY

NORTHROP

Creators and Builders of the ***Black Widow*** *P-61 Night Fighter and the* ***Flying Wing***

combined methods of travel requiring a minimum of an hour.

About 100 active students, nevertheless, make their way to this beautiful field, where four *Cubs*, one Aeronca, one Fairchild PT-19 and a twin-engined Cessna are available. Rental rates are $11 dual, $8 solo for *Cubs*, $18 dual and $15 solo for the Fairchild. The Cessna is available on a charter basis for 30 cents per mile, with twin-engine dual instruction (no solo) obtainable at $35 hourly.

No restaurant facilities are available, so pilots flying here must either bring food or go hungry. Since no hangars are available, only tie-downs for transients can be obtained at $1.50 per night. Monthly tie-down service is $15. All runways and taxistrips are concrete. Runways are 150 feet wide, with the 4,500-foot east-west runway the shortest one on the field.

ARMONK, N. Y. Most distant from downtown New York—30 miles—is the Westchester Airport. The fleet of 13 planes includes eight *Cubs*, two Taylorcrafts, and one each Stinson, Fleet and Fairchild. Pilot comfort was considered somewhat more here than at some fields, with clean rest-rooms, a pilot lounge, showcase with accessories, log books, novelty jewelry, etc., on display. There are three restaurants across the street from the port. Travel time to downtown Manhattan is about one hour. A bus which stops at the field takes 25 minutes to reach White Plains, where express trains afford 33-minute service to Grand Central Station.

Airplane rental charges here differ from the rates at other bases. Smaller planes (*Cubs*, Fairchild) have a charge of 29 cents added to the dual and solo fee to cover insurance costs. *Cubs* rent for $10.29 per hour dual or $8.29 per hour solo. The Fairchild PT-19 is $18.29 dual, $15.29 solo per hour. For the Fleet, dual instruction is $15.79 and solo time $13.79 per hour.

Hangarage for *Cubs* is $25 per month, $1.50 overnight; for Stinsons, $30 with the same overnight fee, and for Fairchilds, $35 monthly and $2 overnight. Tie-down on a monthly basis is $15, or $1 overnight regardless of plane type.

Most urgent private-flying problems made evident by this survey seem to be need of better ground transportation and more hangar space. The influx of ex-service pilots will further increase the number of Gotham's resident-owned aircraft. Such pilots will want to land at airports reasonably close to their destination and feel assured their airplane will be properly handled and serviced—a combination almost impossible to find at the present time.

Mayor Fiorello H. LaGuardia of New York City announced that the City Planning Commission has "for quite some time been surveying private and sports flyer requirements in the metropolitan area." A Class 2 field for the Bronx and a Class 3 field for Staten Island are planned, with full hangaring and service accommodations for permanent and transient aircraft. But consummation of this plan is at least two years in the future. For the present, conditions shown here are typical. END

Icing in Flight

(*Continued from page* 48)

propeller blades and less into the thrust necessary to maintain flying speed.

If your plane is equipped with an alcohol and glycerine de-icer, use it in *anticipation* of icing conditions and leave it on instead of waiting until ice actually forms on the blades. If the de-icer is working properly on a multi-engined plane it can be known by the sound of ice being thrown against the fuselage. If it is not working and if ice is forming, you'll get some vibration due to an unbalanced propeller.

Another method of ridding the propeller of ice is to open up the throttle and increase the r.p.m.'s. The propeller will sometimes throw off the ice due to the increase of centrifugal force action on the ice particles. Increasing the r.p.m. may not necessarily increase the air speed because the propeller cannot bite with high r.p.m. and low air speed. In this case, you can regain your air speed by nosing down into a power glide and *then* gradually decreasing the r.p.m. The additional air speed you gain will give the propeller a chance to take hold. If you can avoid it, don't let propeller ice develop to this point. Come down while you can still make a power landing.

Unlike other ice, carburetor ice does not depend on visible moisture in the atmosphere, nor on freezing temperatures. It may form when outside temperatures are well above freezing, and in *clear air* if the humidity is high. Although the temperature in the carburetor adapter may be from 30° to 60° colder than the outside air, throughout the critical range (40° to 80°)—a condition which creates a refrigeration effect is caused by the expansion of air and vaporization of gasoline. When the outside temperature is around 65°, the temperature in the adapter is near the freezing point and conditions for the formation of carburetor ice are ideal.

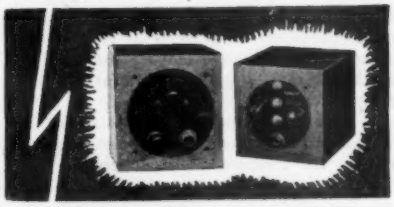
There are three types of carburetor ice—impact, throttle, and fuel ice. Impact ice forms from water out of the atmosphere, from snow, sleet, or sub-cooled water droplets which freeze on contact with surfaces that have below-freezing temperatures, in the same manner and at the same time that structural ice forms on the surface of the plane. It is most dangerous when it collects on the metering elements of the carburetor, affecting fuel-air ratio.

Throttle ice forms at or near a throttle in a partly closed position. It forms mainly from particles which freeze in the air stream and are deposited on metal surfaces around the throttle. The maximum temperature at which throttle ice forms is only about 37°. Ice forms in the central part of the air stream at carburetor temperatures above 37° but metal temperatures are too great for the ice to collect upon it.

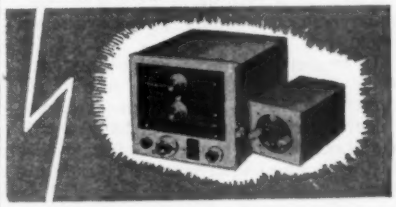
Fuel ice forms as a result of the cooling effect of the fuel evaporating after it

"IT'S *Airline Radio Performance* for the PRIVATE FLIER!"

That's what pilots who tested the new postwar RANGER transmitters and receivers have been saying ever since they made the first test flight. When you're ready for aircraft radio, look to RANGER . . . for fine quality . . . fine performance . . . for aircraft radio priced to meet your approval.



The Model 117 receiver and Model 210 transmitter—both dry-battery powered—offer two-way performance never before available in small aircraft radio equipment. The "117" receiver is a 5-tube superheterodyne of advanced design covering the 195-410 KC band, and is only 3¾" cube. It weighs but one pound and 12 ounces. The "210" transmitter matches the "117" in size and weight, yet puts out a powerful signal. Both may be mounted on the instrument panel and operated from a single battery pack.



The 116/209 combination provides trailing-wire performance with a fixed antenna. The "116" is a 5-tube superheterodyne receiver with extremely high selectivity and sensitivity. It is powered by the Model 209 transmitter, and is its remote control. Range, 195-410 KC. The "209" 12-volt transmitter has over 15 watts output. No pilot-tuning, no gadgets—it is tuned and locked when installed. The 116/209 two-way installation weighs less than 16 pounds complete.

RANGER VHF equipment will be ready when CAA VHF facilities are established. Present frequencies will be continued for several years after VHF ground equipment is installed. It will be two years before VHF will be generally available in ground stations.

Free RANGER PILOT AIDS

Pocket-Size Range Station Finder. Lists all Radio Range Stations in the United States by call-letters and location.

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is introduced into the air stream. It may form at carburetor temperatures considerably above freezing because most of the heat necessary to evaporate the fuel is supplied from the air as it drops in temperature during the process—which is really a refrigeration process in itself.

Fuel ice, or fuel evaporation ice as it is sometimes called, may affect air flow by closing the adapter passage to the blower; it may affect fuel-air ratio by interfering with the fuel flow; it may affect the distribution of the mixture to individual cylinders by upsetting the fuel flow at the nozzle distributor, or air flow distribution in the blower. The extent to which these different phenomena may occur depends largely upon the type of carburetor.

In any case, carburetor ice causes loss of power and air speed if level flight is maintained. It will not cause rough engine operation, for carburetor ice has the same effect as slowly closing the throttle in that it cuts down the amount of mixture reaching the cylinders.

A different icing condition occurs in the carburetor when outside temperature is near the freezing point. Then the carburetor temperature is about zero and what occurs in the carburetor is actually a harmless little snowstorm rather than an accumulation of ice in the adapter.

On the other hand, ice may form on the throttle valve, causing it to stick. At any time when you can observe impact ice, conditions are ripe for this to happen. So whenever you see impact ice, don't fly with your throttle in a fixed position—move it occasionally to keep it from sticking.

If impact ice forms inside the pitot tube or on the pitot head, results are direct and drastic. The airflow about the opening on the pitot head is changed with resultant changes in pressure transmitted to the airspeed instrument. This means incorrect airspeed readings. If your plane has a device to heat the pitot tube, turn it on whenever you anticipate ice in the slightest degree.

In general, mountains tend to intensify icing conditions because of the probable turbulent conditions. Weather is often more severe in coastal regions than to seaward due to the rough terrain usually found along coasts.

On the windward side of mountains you may expect a region of turbulence in the clouds, caused by vertical air currents. If you leave an airport on the windward side of a mountain, *don't* fly directly through the severe icing conditions of this turbulent region. Circle away from the mountains until you have enough altitude to fly over the clouds, or through them at a level where temperatures indicate less severe icing. In landing, your procedure should be just the reverse—fly well to windward of the mountain before you come down.

If you are flying above a low layer of broken clouds with freezing temperatures and have approached within gliding distance of your landing field, if you go into a normal, slow descent through the clouds on a long diagonal glide-path, your plane will be surrounded by moisture and freezing temperatures for a long time. When you finally land, your plane might be heavily loaded with ice.

But if you approach under the same conditions, realizing the possibility of ice in the clouds, and descend rapidly close to the airport, the plane will be in the icing region only a short period of time and cause only a very light ice formation.

The most dangerous of all icing conditions is caused by freezing rain. Proof of this is the terrific ice storms of the eastern seaboard, where tree branches break and high tension power lines are snapped by sheer weight of the ice that adheres to them in the form of long, dangling pendants. If you flew very long in a freezing rain your plane would ice up in the same manner, but naturally aircraft won't sustain any such ice load or even a fraction of it.

If you get into a region with this condition, remember the surfaces of your plane and the air around it are below freezing. Drops of rain will freeze on impact and a coating of hard, clear ice will form, not only on the leading edges of the wings, but over the entire surface of the plane. You will then be fighting an increased stall-speed and a dangerous increase in weight as well.

Freezing rain indicates above-freezing temperatures in the clouds aloft, usually only between 1,000 and 5,000 feet above the ground. (This is *not true* of freezing mist, which is only stable cloud particles falling to earth). You can avoid dangerous icing by climbing out of the freezing rain *into* the clouds. Applying the rule that within a cloud temperature drops three degrees with every 1,000-foot increase in altitude, if you go too high you will run into icing conditions again. Consequently, on first encountering above-freezing temperatures level off and proceed at that altitude.

Snow and sleet fall out of a region where severe icing conditions can normally be expected. Thus it is better to avoid the cloud that the snow or sleet is coming from, either by flying over it or under it in the area where the clouds are formed as a *result* of the precipitation and hence are of little concern. Briefly, in flying through snow or sleet, fly through the area where they are falling—*never* in the clouds where they are originating.

The exact reverse is true of freezing rain, where the danger area is where the rain is falling and the safety area is where it originates. Freezing rain indicates a temperature inversion, or increase of temperature with altitude. Under inversion conditions there is no rule-of-thumb that will give the temperature change in ratio to the increase of altitude so rely on your outside temperature indicator.

Let's set up an example of a sequence of events you might encounter in cross-country flying. Leaving your airport under a low ceiling, you realize the possibility of icing conditions. You climb rapidly through the broken clouds, using all available power, and break out above with a very light ice formation.

Suddenly you encounter freezing rain, meaning the clouds overhead have an above-freezing temperature. So you climb to a point where above-freezing temperatures prevail, leveling off there, staying low enough to avoid the freezing temperatures still higher in the cloud deck.

Next, you run into a region of falling sleet. This should tell you that a severe icing region must be above you, and since the sleet is not dangerous, you continue at the same altitude. Then comes a region of wet snow which sticks to your plane, and you realize you are running into danger so you climb to a higher, colder level where the snow is no longer an icing problem.

Ahead are some mountains, where you encounter turbulent areas. The temperature is near 25° and clear ice starts to form. Knowing that for every 1,000 feet you climb the temperature will drop three degrees, you climb to about 4,000 feet where the temperature is around 15°. Here you get rime ice, which forms slowly and is less dangerous. If it collects to the point of affecting performance, the next step is ridding the plane of the ice by any of the four previously-mentioned methods, depending upon your airplane and its equipment. END

The GOLDFISH CLUB

The Goldfish Club was formed to recognize the thousands of pilots and aircrewmen who have ditched their aircraft at sea and saved their lives through the use of emergency life jackets and dinghies. To apply for membership in the American division of the Club, the following information should be submitted to the American Secretary, Max Karant, Managing Editor, FLYING, 185 North Wabash Avenue, Chicago 1, Illinois:

1. Name, rank and serial number
2. Service address
3. Home address
4. Date and location of incident
5. Description of incident
6. Signature of applicant
7. Signature of commanding officer

The first 40 members of the Goldfish Club, as they appear on the official club roster, were listed in the November, 1945 issue of FLYING. This listing is continued below:

Phillips, Richard W., N
Engle, Walter R., N
Larsen, Albert L., A
Lemaire, Theodore J., N
Sheets, Raymond A., N
Carpenter, Leamon F., N
Hastings, William H., M
Hadden, Mayo A., Jr., N
Tobin, Patrick W., N
Ingram, M. D., N
Smith, Frederick B., A
Budriunas, Bronislaus, A
Mansdorf, Harry, A
Schwartz, John, A
Wilson, Herbert A., A
Breckenridge, Harry J., A
Gannon, Jack P., A
Bitting, Soule T., N
Ward, George M., A
Rigney, Harold D., A
Mahaffey, James M., A
Turner, Sam R., A
Werry, Leslie E., Jr., N
Suhr, Vincent D., A
Bougan, Charles Evans, N

A-Army, M-Marine Corps, N-Navy

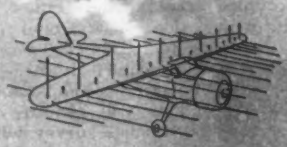
If there's a chance of your owning an airplane . . .

this is important to you

High wing or low wing? Which is the better design for high performance, safety, speed and comfort in your private airplane?

That is one of the major questions that you will have to answer just as we did, and in planning the new line of Cessnas, our answer is definitely *high wing.*

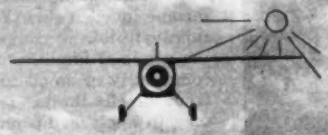
Here are a few of the reasons why . . .



1. The high wing design is more efficient because it provides greater lifting power, particularly when the top of the cabin is an integral part of the center section of the wing. In fact, only such a high wing design permits an uninterrupted flow of air, and consequent *lift,* over the entire span of the wing from tip to tip.

   This means that you can get in and out of small fields more easily.

2. A high wing airplane has greater inherent stability . . . a natural tendency to maintain smooth, level flight . . . because the weight of the fuselage is below the lifting surface.



3. There is better visibility of the ground for both pilot and passengers in a high wing airplane. Flying is easier, more interesting and enjoyable because you get a full view of the country below unobstructed by the wing area.

4. It provides protection from the sun during flight, and from snow and rain while passengers are getting in or out of the plane.

5. High wing design permits placing the fuel tanks up in the wing. This affords dependable flow of fuel to the engine by the natural force of gravity instead of requiring the addition of some sort of mechanical pump.
6. A high wing is much less likely to be damaged by high weeds, occasional boundary lights, fence posts, etc.

Those are the highspots in our reasoning on the high wing vs. low wing question. It's more for your money. Our judgments are based primarily on 35 years of leadership in making fine aircraft. Beyond that, we have flown, tested and analyzed planes representing the full range of design. We have explored every resource we know.

Early in 1946 we are planning to introduce the first of our new line of Cessnas. It will be a high wing, two-place, metal airplane, with the new, patented Cessna safety landing gear. This new Cessna will be superior in performance, yet competitive in price in the low-priced, light plane field.

CESSNA AIRCRAFT COMPANY • WICHITA, KANSAS

Cessna

THE PILOT'S AIRPLANE

Planning Your Home Town Airport

(*Continued from page 34*)

which should be taken into consideration. No site is likely to satisfy them all but the degree to which they may be met at several alternative locations should provide the basis for a sound appraisal of respective merit. The complexities of the matter make a mechanical solution almost impossible. The following check sheet will serve mainly to assure that the more important factors are not overlooked. It is desirable that an airport be located so that it will be:

1. Close—in time—to the destination and source of those who will use it.
2. Near—in distance—to other means of transportation (highway, railroad, waterway); to established airways (if the field is to serve commercial carriers); to public utility lines.
3. Relatively free from ground fog, smoke and adverse air currents.
4. Capable of satisfactory and economical development (providing clear approaches, and capable of grading, drainage, paving, landscape development, and providing buildings and equipment commensurate with anticipated use).
5. Accessible to sources of supplies and services (fuel and replacements, housing and community facilities for airport users and airport and airline personnel).
6. In conformity, so far as possible, with the planned community and the present use of contiguous areas.

It is assumed that those responsible for airport planning in the respective metropolitan areas of the country will be most familiar with the way in which local conditions probably will affect the growth of aviation in each region. Each planner probably will prefer to devise methods of estimating such factors that are best suited to his particular locality.

In the sphere of lightplane operations, there is substantial agreement that a knowledge of the number of people likely in the future to buy and operate their own planes, and a knowledge of where those potential owners live in the community, will give the planner a clue to (1) the number of small fields that will be necessary and (2) the general areas within which he must try to provide them. Accordingly, the following method has been devised for finding the location and density of wealth (in terms of family income) throughout the population of a metropolitan area, and the varying percentages of each income group who are potential airplane owners.

In order to separate the population into income groups for the purpose of estimating potential plane owners, easily available census data are used and the information broken down and tabulated under general headings. The "high income group" includes all owner-occupied and tenant-occupied dwelling units with estimated or contract rentals of $75 per month or over. The "intermediate income group" includes all owner and tenant-occupied dwelling units having estimated or contract rentals from $50 through $74 per month.

Tenant-occupied farm dwelling units are not to be included in the airport study, but owner-occupied units should be included if the number and value of such farm homes appears to be significant and if they are a part of the metropolitan area. The values to be included range from $3,000 to $10,000. All farm houses of $5,000 in value and over should be placed in the high income group, while those valued from $3,000 to $5,000 should be placed in the intermediate income group.

The three rental groups should be plotted on a base map of the metropolitan area showing the state, county, city and borough boundary lines, and all natural features according to their geographical position.

Many county and regional planning committees have made studies of the existing land use, proposed land use and future trends in the growth of communities. That type of information is invaluable and necessary in planning. On the other hand, there are many metropolitan areas where either none or only a portion of the civil divisions have been studied. In such cases it will be necessary to acquire the necessary information by making a simple reconnaissance survey. This will require county participation.

Such a survey will require very little work for one familiar with each county. In fact, the largest portion of the data required already is available in the form of county, township and borough maps. However, additional information showing the general location of the type of residential areas, location of commercial and industrial areas, the direction of growth of the two areas, location of areas containing private estates, location of open land which appears to be suitable for airport use; and location of obstructions within three miles of the open land.

So many variables must be considered in estimating the number of potential plane owners in a metropolitan area that no uniform criteria can be used. For example, it is obvious that the percentage of potential plane owners within the high income level in New York City would be relatively low in comparison with a similar group of families living in a suburban community or small town, 20 or 25 miles from the city limits. That makes it necessary to analyze the physical characteristics of the metropolitan areas, taking into consideration the significant factors which tend to increase or decrease the need for a plane.

The factors to be considered are the per cent of building coverage; density, or dwelling units per acre; existing and proposed land use (industrial, business, residential); types and adequacy of the existing transportation system (railroads, rapid transit lines, bus lines); the num-

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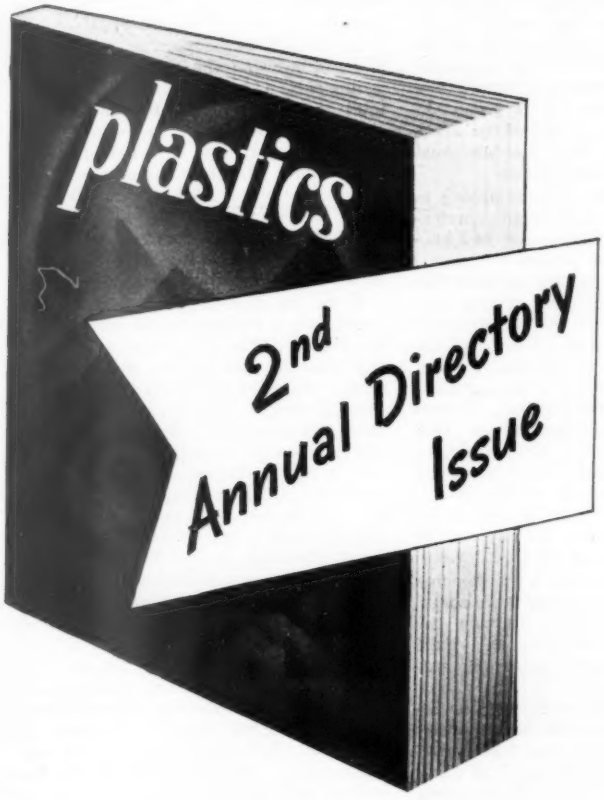

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ber of available airport sites and the feasibility of converting arrested areas, blighted areas, or slum areas to airport use; the probable effect of an airport (adverse or favorable) to land values in the area; air-mindedness of the people in the community; wealth distribution; travel habits of the population.

In view of the effect that the foregoing factors will have upon the number of potential plane owners, and in view of the varying degrees between the minimum and maximum influence such factors may have, no uniform policy can be given. In other words, no two metropolitan areas can be treated alike. Each problem must be analyzed by the local people.

To obtain some idea of the approach to the problem, assume a theoretical metropolitan area, having a population of 3,000,000 people and with a central city population of 1,700,000. Having studied the factors mentioned previously as they pertain to the problem, it will be apparent that the central city and a portion of the county adjacent to it are similar in character, having a high density per acre, excellent surface transportation, intense land use and very high land values. This would indicate that all of the areas having these characteristics should be placed in one category. It may be called Zone 1, which includes other areas 25 to 30 miles from the central city that are also similar in character, but smaller in area.

As the study progresses, it will become apparent that there are three more zones, all having characteristics affecting the number of potential plane owners. Each zone will have a different set of percentages as follows:

Zone 1: High income group, .025 or 2½ planes per 100 households; intermediate group, .005 or ½ plane per 100 households; medium group, .001 or 1/10 plane per 100 households. Zone 2: High income group, .05 or 5 planes per 100 households; intermediate group, .05 or 5 planes per 100 households; medium income group, .001 or 1/10 plane per 100 households. Zone 3: High income group, .10 or 10 planes per 100 households; intermediate group, .05 or 5 planes per 100 households; medium group, .005 or ½ plane per 100 households. Zone 4: High income group, .15 or 15 planes per 100 households; intermediate group, .05 or 5 planes per 100 households; medium group, .005 or ½ plane per 100 households.

These percentages are generally applicable to the average metropolitan area. For such areas as New York and Chicago, where extremely high density in population and area in square miles exists, the first zone should be reduced as follows: High income group, .005 or ½ plane per 100 households; intermediate group, .001 or 1/10 plane per 100 households; medium group, .0005 or 1/20 plane per 100 households.

It has been estimated that for the United States as a whole there will be 300,000 planes three years after the war and 500,000 planes 10 years after the war. To adopt a conservative estimate in computing metropolitan plane loads, assume a figure of 400,000 planes 10 years after the war. Since the estimates being used here are based upon wealth distribution in the upper income levels which have been transmitted from rentals, we are only dealing with a comparatively small percentage of households for the country as a whole, including occupied rural farm units. In the U. S. there is a total of 6,013,840 households in the three rental categories which may be considered potentials as against a total of 35 million households in all of the rental ranges.

Let 204,521 be adopted as the number of households in the three upper rental groups in "X" metropolitan area with a total population of 3,000,000 people. That would place the percentage of households in "X" area at three per cent of the nation's total. Therefore, three per cent of approximately 400,000 planes 10 years after the war equals a total of 13,600 planes in "X" area, or about one plane to every 15 households, or every 57 persons in the three high rental groups.

If we are dealing with 204,521 households in our highest rental brackets and in a metropolitan area having characteristics equal to Zone 4, the estimated potential of 13,600 planes would be reasonable. However, since we are dealing with four transportation zones having varying degrees of accessibility, density and wealth distribution, it is obvious that the potential of 13,600 planes is high. Therefore, the percentages applied in each zone are adjusted in proportion to the characteristics in each of the other zones. When the percentages are broken down to three rental ranges and four zones, the potential plane load 10 years after the war will be about 4,000 planes.

Those planning studies of potential plane loads in relation to rental groups and the natural elements of a metropolitan area should show all existing and proposed highways, parks, railroads, rapid transit and bus lines on the base map of the cities, counties, townships and boroughs in the area. Using that information in conjunction with the study on wealth distribution, studies can be prepared to show the total plane load for a given area. General areas best suited for airport location can then be determined.

An essential part in carrying out any general plan is the preparation of a long-range program and capital budget. The estimates of need used in arriving at the over-all, ultimate plan may be examined and broken down to show the expected air traffic loads and the anticipated airport requirements during the first year and each succeeding year for a 5- or 10-year period. Then a program may be developed which will contemplate land acquisition, construction and maintenance—each at the proper time.

Suitable available airport sites frequently will be so scarce that their acquisition quite a while in advance of actual construction will be advisable and will usually pay dividends in lower total cost. If estimates of need later are found to be too high, other uses for the land usually will easily be found and the community will not incur financial loss.

A program of specific action one year ahead, a more general five-year program, and a broad program for 10 years in advance can be projected from the estimates of need. END

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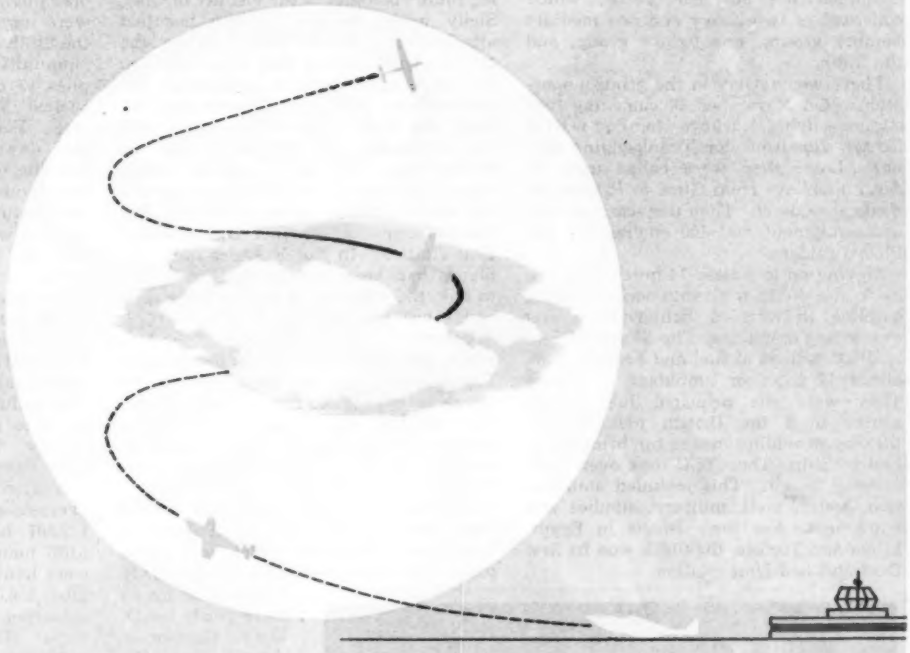

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TCC—Front-Line Teamsters

(*Continued from page 29*)

Activated February 12, 1942, the 316th trained at Patterson Field, Bowman Field, Lawson Field, Del Valle Air Base in Texas and went overseas, November 16, to Deversoir on the Suez Canal. There it joined the 9th Air Force, which consisted of two heavy and one medium bomber groups, one fighter group, and the 316th.

There was variety in the group's operations. On November 26 came the first mission—flying turkeys to forward fighter squadrons for Thanksgiving dinner. Later they were called upon to carry monkeys from Gura to Eritrea for medical research. Then they carried oxygen equipment and 100 engines for the Ploesti raiders.

Moving on to a base 14 miles from Tobruk, the group went into action hauling gasoline to forward fighter units and evacuating casualties. The *Skytrains* carried 800 gallons of fuel and brought back either 12 litter or ambulant casualties. They were the principal fuel supply source until the British took Tripoli, thereby providing means for bringing in fuel by ship. Then TCC took over high-priority freight. This included ammunition, water, mail, military supplies and equipment. For their efforts in Egypt-Libya and Tunisia, the 316th won its first Distinguished Unit citation.

Moved on to bases at Nouvion, Gersif, and Enfidaville, in preparation for the Sicilian invasion, the group became part of the 12th Troop Carrier Command. On July 11, 35 planes took off on a dog-leg route via Malta to the vicinity of Gela, Sicily, where German bombers had just attacked our Naval units. When the 316th's planes arrived they were mistaken for the enemy. Intense antiaircraft fire knocked out 12 planes. Despite this setback, the 316th delivered its paratroopers, signalizing the first large-scale use of American airborne forces to disrupt enemy defenses so as to assure a victorious assault by our seaborne troops. For this performance: another Distinguished Unit citation. In North Africa only two planes had been lost by the 316th—one to flak, the other to an enemy mine on a newly occupied landing strip.

There was not a single loss, however, when the 316th assisted in the Naples-Foggia campaign by dropping relief troops at Salerno to relieve enemy pressure on the Allied beachhead. Aerial supply was maintained in the northward drive of our Fifth Army there and in the Rome-Arno campaign.

In February, 1944, the 316th moved from the Italian base of Paceco to Cottesmore, England, which was to be their base until returning to the U. S.

The TCC boys were ready on D-Day, Normandy, June 6, 1944. Cooperating with 13 other Troop Carrier Command groups, the 316th was at the head of the accomplishment list in the Normandy operation. They sent out 72 planes without losses, hauled two battalions of the 505th Paratroop Regiment and set them down at St. Mere Eglise. There were no losses until D-plus-one. While hauling rations and ammunition, two of the 316th's personnel were killed in a taxiing accident.

Northern France paralleled operations in North Africa for the 316th, now wearing its third citation. Thousands of gallons of gasoline were rushed to advance bases and casualties were rushed back to hospitals in England. The group sent out eight serials (missions in a 24-hour day by a unit) when glider and paratroopers of the 1st Allied Airborne Army went into Holland in its initial operation. Seven planes of the 316th were lost that day. On Christmas, 1944, the 316th sent 52 planes to Bastogne with ammunition, rations, and medical supplies to our ground forces holding out against Von Rundstedt's counter-offensive. Four of the 316th's planes were shot down (one crew returned safely), but due to heavy enemy fire only six of the group's planes were flyable upon their return to Cottesmore. Much of the damage was from small arms fire, so low had the unarmed "sitting ducks" been flying.

The final operation in Europe was over the Rhine on March 24. More than 1,000 paratroopers with full equipment were delivered to a drop area near Wesel. The 316th was but one part of an operation that included 1,600 planes and 1,400 gliders—the greatest airborne operation in history. Those troops quickly captured 4,000 German prisoners and six bridges.

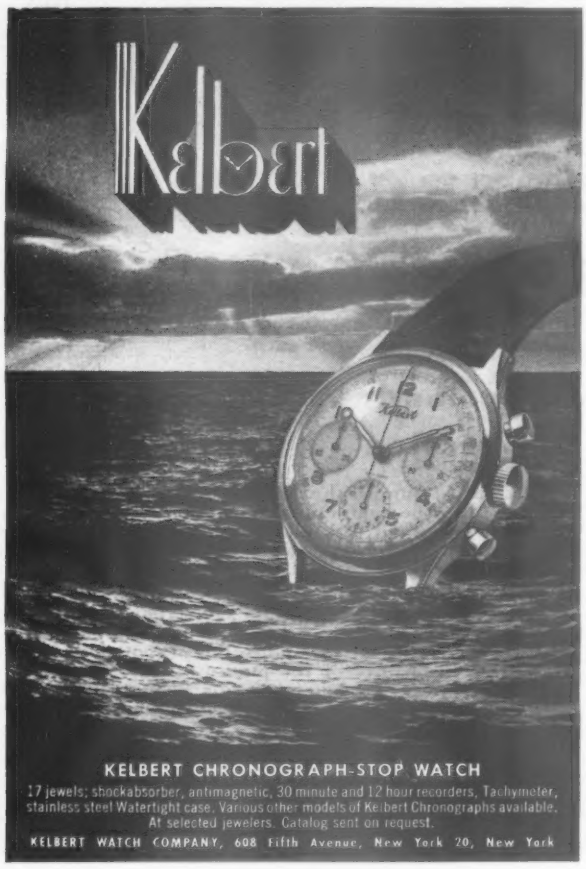
A statistical summary of the 316th's overseas efforts is impressive. They flew 122,597 hours; gliders were borne for 5,625 hours; 50,489,577 pounds of freight were hauled; 19,967 patients were evacuated; 106,089 passengers were flown; 5,420 paratroops were carried on combat missions. Two of the group's four commanding officers, Lieut. Col. Burton R. Fleet and Col. Harvey A. Berger, were killed in action. The only time the 316th was provided fighter cover was over Holland. There was a 100 per cent turnover in planes.

TCC *Skytrains* were able to carry any single piece of equipment except the 39,500-pound Long Tom gun. While not basically sustaining in supplies, TCC was able to supply two divisions at Arnhem for from four to five days.

Whereas TCC spearheaded each tactical airborne assault in Europe as a primary function, in the Pacific airborne attacks were a secondary function. Troop Carrier's primary concern in the Pacific was the tieing-in of the vast pattern of American bases. Without railroads or truck lines, slow surface vessel supply movement made the TCC job vital to the success of all of General MacArthur's advances.

Beginning with the 13th Troop Carrier Squadron at Plaines des Gaiais in New Caledonia, TCC supplied all our advance ground and air combat units. They expanded, pushing on from depots in Australia, later New Guinea and the Solomons. They rushed cargoes of men, food, ammunition, and equipment despite bad flying weather, poor living conditions, and lack of repairs.

During an 11-month period, one squadron of 20 planes evacuated 5,775 wounded, carried 18,385 passengers and 4,691,294,000 pounds of freight to the front. In one month a single Troop Carrier squadron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Another TCC squadron helped revolutionize the science of logistics, upon which all tactical success depends, by flying the Hump to supply the 14th Air Force during its first six months overseas. Later that same unit moved to India to fly thousands of food missions to General Stillwell's army and to Gen. Frank Merrill's Marauders. Establishing a base in China in 1943, this squadron broke the tonnage record of the China National Aviation Corporation. With only 10 per cent of the planes in the area, the squadron flew 60 per cent of the tonnage over the Hump in March and April of 1943. From February 12 to June 30, 1943, they flew 1,176 trips over the Hump without loss of equipment or personnel.

In February, 1944, this same unit delivered, 5,600,000 pounds of supplies to troops on the front lines or behind enemy lines.

The work of TCC is far from a dull, routine job. At Wau, New Guinea, Troop Carrier planes landed on a field still being defended by Japs. As the planes came to a stop, troops jumped from the planes and encountered enemy opposition immediately. Four TCC personnel were killed by small arms fire. Japs were within 100 yards but the planes were able to take off after unloading.

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When strong tropical winds prevented the unloading of supply boats off the shore of Peleliu, troops engaged in the island battle ran short of rations. Thirteen TCC planes came to their rescue, dropping 36,000 ration units by parachute.

One Troop Carrier Command plane with 19 wounded and ill evacuees aboard, was forced to land, due to failure of voltage regulators and to fuel shortage, on a coral reef 100 miles from its destination. With too many men for the life raft, the pilot directed the crew in stripping the *Skytrain* of all steel cables, and anchored it to the reef. He then had the stretcher litters adjusted well above the water line. He and his crew then climbed to the top of the fuselage and stood watch for 11 days and nights. Rain fell steadily for five days. Their emergency radio finally got through to another TCC plane and it came by to drop food and water. The supplies landed in the water, but the pilot, though weakened by exposure, dove into the water and recovered the rations. On the 11th day a Navy destroyer arrived to rescue the men. Not a life had been lost.

During the time I was with the Tenth Air Force Troop Carrier squadrons in the China-Burma-India Theater, I had opportunity to note the progress of airborne operations. Our tactical supply operations were pioneered by Gen. Joseph Stilwell and I believe his far-sighted policy was largely responsible for our victory in Burma.

At the end of the monsoon season in the autumn of 1943, the Japanese occupied almost all of Burma. British forces held the line south of the Indian border along the Bay of Bengal in the Arakan. A second British force was deployed from Tiddim along the Chindwin river in central Burma, and in the north Allied forces were protecting the Ledo road. From their bases in Burma, the Japs were hammering as far as Calcutta in aerial thrusts while still maintaining the initiative on the ground. They were poised for an invasion of India.

In February, 1944, the Japanese invasion enveloped the Indian Seventh Division in the Arakan. A year earlier a similar maneuver had turned an Allied offensive into retreat. This time our Tenth Air Force Troop Carrier planes, strengthened by ATC planes, flew in supplies and flew out casualties, enabling the Seventh to stand firm and hold off the only real invasion threat to India.

Then we took the offensive with outfits like Col. Philip G. Cochran's First Air Commando Group and Maj. (then Brig.) Gen. Merrill's Marauders. We towed gliders 150 miles behind the Jap lines and built our own airfields, leading to disruption of the Jap communications, and round-the-clock attacks on enemy airfields in the Mandalay area. The second Jap offensive of 1944, when they crossed the Chindwin river, was eventually check-mated. Troop Carrier flew 758 sorties; transported an entire division with pack animals; kept 200,000 troops supplied with 28,120 tons of supplies, food and ammunition in that 80-day battle. Three Jap divisions were virtually annihilated.

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When strong tropical winds prevented the unloading of supply boats off the shore of Peleliu, troops engaged in the island battle ran short of rations. Thirteen TCC planes came to their rescue, dropping 36,000 ration units by parachute.

One Troop Carrier Command plane with 19 wounded and ill evacuees aboard, was forced to land, due to failure of voltage regulators and to fuel shortage, on a coral reef 100 miles from its destination. With too many men for the life raft, the pilot directed the crew in stripping the *Skytrain* of all steel cables, and anchored it to the reef. He then had the stretcher litters adjusted well above the water line. He and his crew then climbed to the top of the fuselage and stood watch for 11 days and nights. Rain fell steadily for five days. Their emergency radio finally got through to another TCC plane and it came by to drop food and water. The supplies landed in the water, but the pilot, though weakened by exposure, dove into the water and recovered the rations. On the 11th day a Navy destroyer arrived to rescue the men. Not a life had been lost.

During the time I was with the Tenth Air Force Troop Carrier squadrons in the China-Burma-India Theater, I had opportunity to note the progress of airborne operations. Our tactical supply operations were pioneered by Gen. Joseph Stilwell and I believe his far-sighted policy was largely responsible for our victory in Burma.

At the end of the monsoon season in the autumn of 1943, the Japanese occupied almost all of Burma. British forces held the line south of the Indian border along the Bay of Bengal in the Arakan. A second British force was deployed from Tiddim along the Chindwin river in central Burma, and in the north Allied forces were protecting the Ledo road. From their bases in Burma, the Japs were hammering as far as Calcutta in aerial thrusts while still maintaining the initiative on the ground. They were poised for an invasion of India.

In February, 1944, the Japanese invasion enveloped the Indian Seventh Division in the Arakan. A year earlier a similar maneuver had turned an Allied offensive into retreat. This time our Tenth Air Force Troop Carrier planes, strengthened by ATC planes, flew in supplies and flew out casualties, enabling the Seventh to stand firm and hold off the only real invasion threat to India.

Then we took the offensive with outfits like Col. Philip G. Cochran's First Air Commando Group and Maj. (then Brig.) Gen. Merrill's Marauders. We towed gliders 150 miles behind the Jap lines and built our own airfields, leading to disruption of the Jap communications, and round-the-clock attacks on enemy airfields in the Mandalay area. The second Jap offensive of 1944, when they crossed the Chindwin river, was eventually check-mated. Troop Carrier flew 758 sorties; transported an entire division with pack animals; kept 200,000 troops supplied with 28,120 tons of supplies, food and ammunition in that 80-day battle. Three Jap divisions were virtually annihilated.

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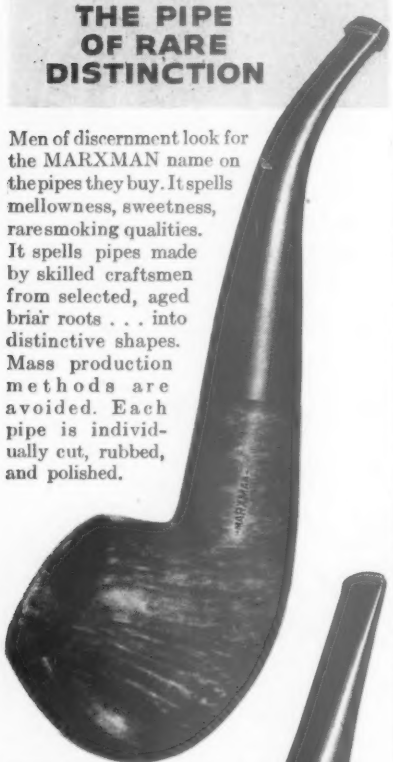

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vital Myitkynia airfield, Troop Carrier supplied our forces with 98,823 tons of supplies; flew in 75,000 men; evacuated 10,000 casualties in the May-October period of 1944. It all added up to Allied victory in Burma. That victory was of grave consequence to the Japs, for it deprived them of an entire flank and left them wide open to further assault in southeast Asia.

It took weeks for the Japanese to dislodge us from Corregidor when we were abandoning the Philippines in 1942. But when General MacArthur led us back, paratroops dropped right on top of the Japs imbedded on Corregidor and within a few days that fortress guarding the harbor of Manila was entirely in our hands. Combined paratroop-glider drops were also made on Leyte, Luzon, and Manila.

Other new techniques have been tested and developed. Pathfinder units, which precede main forces in an airborne operation to designate drop or landing zones for paratroop or glider troops, have been successful. Snatch pickups of gliders by tow planes, which swoop near the ground and hook a tow rope without halting in flight, have proven very worthwhile in operations as time-savers.

A final word about our gliders. We have used the Waco CG-4A, which can carry about 15 men or similar weight in equipment and supplies; the Waco CG-13, with about twice the capacity of the CG-4A; the Airspeed *Horsa*, a British model similar to the CG-13; the one experimental model CG-15, quite similar to the CG-4A; the CG-10, also experimental, with 10,000-pound-plus capacity.

Troop Carrier Command has served exceptionally well strategically by bringing up supplies to forward bases; tactically, by supplying assault forces in initial stages of attack, and by helping to win battles in jungle country. From a morale standpoint it has served brilliantly. And it has accounted for the evacuation of about 1,000,000 casualties. END

Our Plans for 1946

(*Continued from page 22*)

to start the training of a number of students in the spring.

We are anxious to start CPTP again in a modest way for it is one of the most effective means yet discovered to get the youth of the nation interested in aviation. The plan will offer training to women as well as men. If aviation is ever to be accepted widely as a family convenience we have got to sell the women.

Pilot training cannot go on indefinitely as a burden on the Government, so we plan to reduce public financial participation gradually until this program becomes self-supporting in a matter of years. The program as we see it now will be conducted entirely under the sponsorship of colleges, although a percentage of students will be non-college men and women. The educational institutions can set up their own training bases or, as most of them did in the earlier program, farm out their students to private enterprises on a sub-contract basis.

The Federal investment in these courses will be limited to 75 per cent. The colleges must bear one quarter of the cost, which will probably be passed on to the students in the form of fees. Thus, assuming a private pilot's course costs $360, the Government will provide $270 and the schools will make up the difference.

The CAA recommendation for a Federal-aid airport program, which was devised primarily in the interests of private flying, is fairly well-known. By its provisions the Federal Government will match state funds to build thousands of new airports at locations strategically sound from the standpoint of the private owner.

The CAA is acutely conscious of the fact that the use of aircraft is limited by the availability of airports just as the use of autos used to be limited by the availability of roads. This is one reason for my desire to develop cross-wind landing gear that will make one-runway airports practical. The considerable developmental cost will be amply repaid in the savings of millions in airport construction.

On the subject of landing fields, it might be well to mention that we are working closely with other Government agencies on the use of sites no longer needed by the military. No disposal can be made of surplus airfields until we have had an opportunity to assess their potential value to the communities nearby and to our air transport system as a whole.

In the field of air transport we will expand our work on airways facilities, push the adaptation to civil use of warborn devices, and establish many new foreign offices to keep pace with overseas expansion of the airlines. Already three of our men, Chris M. Lample, Fred M. Lanter and James L. Kinney, have made a world tour, observing ATC facilities and methods in areas where American flag carriers will operate. We have two men now in Germany advising the Allied Control Commission on setting up facilities for commercial flight.

Whenever the airlines get into high gear on their foreign routes, presumably in 1946, the CAA will staff offices at strategic locations with technicians for it is our job to see that the high standards of American aviation are maintained wherever there are American aircraft. These offices—eventually 16 of them—will correspond to our regional offices at home except that at the start they will be concerned primarily with air transport.

At our developmental station at Indianapolis we are working out possible applications of radar to civil aviation as well as the further development of many radio aids. We have there examples of each device used by the Army and Navy. Most of them will require much adaptation before they can be used economically and several years will pass before they become practicable. However, the monitoring screen, which gives its operator a picture of air traffic in the vicinity of the airport, will be installed in some control

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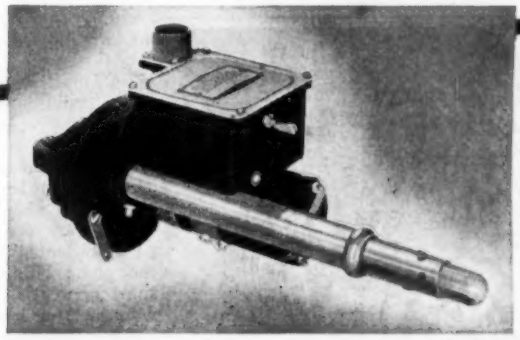

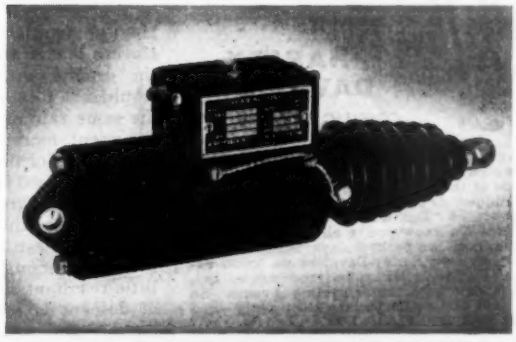

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towers within a reasonable time. The fascinating variations in radar devices and what they will do for air transportation within only a few years make an interesting story in themselves.

The CAA has completed installation of very high frequency radio facilities on a few of the principal airways, notably New York-Chicago, and will have changed over most of the airways radio network by the end of next year. The three-element blind landing system, having been proved effective at Indianapolis, has been completely installed at eight large airports and work is continuing to equip about 100 major points with this important device which will guarantee a higher degree of schedule regularity for the airlines. The latter are beginning now to install VHF receivers and blind landing indicators in their planes.

Alaska, which is destined to become a most important point in our international air transport system, has been provided with much excellent airways equipment for Army use. We hope to assume the operation of most of the facilities left there but that accomplishment must follow much discussion and decision on budgetary matters. The AAF may find uses for their Alaskan installations in other areas but we are reasonably certain that enough will be left there to give an important boost to aviation.

The matters that I have mentioned form the major part of our job for 1946 but by no means cover our whole program. Our Office of Aviation Information, for instance, will produce informative studies and analyses that will benefit the industry and the public alike. Our program of technical assistance to high schools and elementary schools educating youth in aviation will be carried forward. We shall continue to collaborate with other countries in working out technical standards for international aviation at the meetings of the Provisional International Civil Aviation Organization at Montreal.

Above all, it is my intention to work in harmony with the manufacturing industry, commercial aviation and private flying groups to bring aviation to its full significance in a United States at peace. Only by co-operation in working toward the common goal—aviation for all—can we who believe in its destiny help to bring about its fulfillment. END

The Stall Landing is Not Obsolete

(*Continued from page 30*)

over the wings, and some lift. Therefore an aircraft which has just decreased its speed below its normal stalling speed is *not* a freely falling body. Even were it falling freely, it would be slowed down so much by the buoyancy of the air that its fall would be more comparable to that of a leaf than to that of a stone. Moreover, Hoyt assumed that there was an actual instant at which the plane could be said to have stalled, an instant from which its fall could be computed. Actually, planes do not stall in a split second. They more or less mush into the stall and there is a short space of time during which they are partially airborne and partially stalled. In a good stall landing the plane hits the ground during this short space of time (which is ignored when a "free fall" is computed).

After erroneously computing the rate of descent of a plane after a full stall, Hoyt plunged deeper into his error by declaring that a plane flown right on in to the ground without breaking the glide would not hit the ground any harder if the same rate of descent were held. This argument ignores the all-important forward speed of the plane. One component of that forward motion would be at right angles to the ground and would account for a part of the shock landing. To say that a plane can be literally flown into the ground "without breaking the glide" with little resultant shock (as long as the rate of descent is low) ignores the forward motion of the plane.

It is possible to fly a plane (for example) at an airspeed of 80 m.p.h. and a rate of descent of 680 f.p.m. and to fly the same plane at the same rate of descent but with an airspeed of 120 m.p.h. Obviously the latter would result in a much greater impact were the plane flown right on in without breaking the glide. It is, therefore, absurd to contend that a plane flown right into the ground without breaking the glide would not hit with any greater force (if the rate of descent were only 680 f.p.m.) than a plane stalled out 24 inches above the runway. The plane's forward speed is an important factor in the shock of impact and cannot be ignored.

There is no simple formula for computing the rate of descent of a plane in a stall landing because the forces acting upon the plane are far more complex than those acting on a freely falling body. One could therefore argue incessantly as to which type of landing involves the greater shock to the plane. Inasmuch as the wheel landing must be made at a higher speed, it results in the greater wear on tires and, usually, on brakes. The screeching noise which often accompanies a wheels first landing testifies to that fact. As any pilot knows, landings "too soft to crack an egg shell" can be made using *either* the stall or wheels first technique. The universally accepted technique for ditching planes at sea in emergency calls for a *full-stall landing* in order to hit the water with the minimum of shock.

However, forced landings are special cases. Let us return to the basic question: what are the advantages of the stall landing under normal circumstances? With a conventional plane, why make a stall landing?

The simplest and most important argument in favor of the stall landing is the slower speed involved. As has already been pointed out, a stall landing does *not* necessitate a slower speed in the glide when a slow speed would admittedly be dangerous. It *does* necessitate a slower speed at the time the plane touches the ground and immediately thereafter—when a slower speed is a safety factor. In a stall landing, as we have defined it, the plane hits the ground at its stalling speed.

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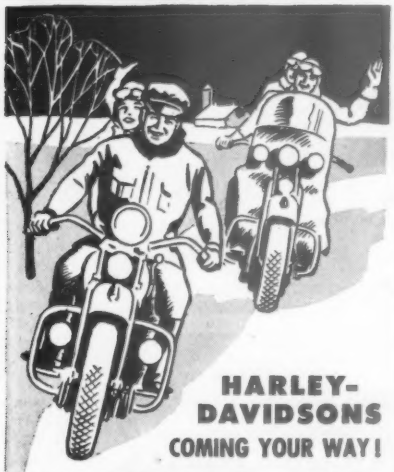

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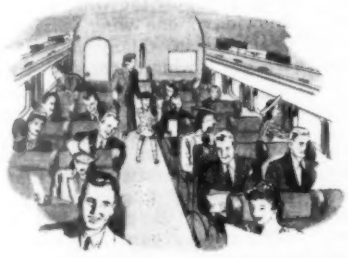

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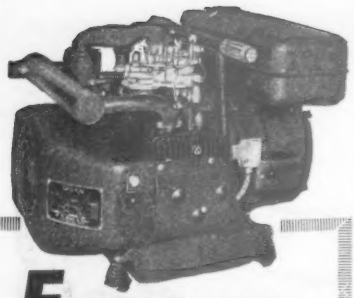

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In order to make a wheel landing (which we have defined as one which involves touching the ground *before* the stalling speed is reached), one must naturally land at a speed in excess of the stalling speed—usually somewhere from five to 15 m.p.h. more. In this single difference lies the chief advantage of the stall landing.

One of the most important hazards in landing any plane arises from the fact that there is an inevitable period during which the plane has a speed greater than a safe taxiing speed but less than safe flying speed because there is not sufficient airflow over the control surfaces to enable the pilot to use them to advantage, and the plane is moving too fast for safe and efficient use of brakes. A high proportion of landing accidents occurs during this period of minimum control. It is therefore logical to assume that any landing technique which tends to decrease the duration of this period will decrease the chances of accident.

In a stall landing, the plane has less speed when it lands. It also has less momentum and will tend to slow down to a safe taxiing speed sooner without the use of brakes. This tendency will be enhanced by the fact that the plane is in a three-point attitude which creates far more drag (i.e. resistance to forward motion) than would the same plane in a normal flight attitude. Moreover, if brakes are to be used, they can (at least in a conventional tail wheel type plane) be used to better advantage after a stall landing than after a wheel landing because the faster landing is usually made with the tail high and the fuselage of the plane parallel to the ground. If brakes are used with the plane in this attitude, a nose-over can easily result from the slightest extra pressure on the brake pedals. The same amount of extra pressure after a stall landing (when the plane would be in a three-point attitude) would merely raise the tail slightly and indicate that the pilot was using too much brake.

Hoyt admitted the paramount importance of decreasing the length of run-off after landing when he declared that point to be "the real bone of contention." He argued, however, that "wheel landings, speed for speed, require a shorter roll if brakes are used." Therein lies the crux of the matter: Wheel landings cannot be compared with stall landings "speed for speed" because, by definition, a stall landing results in a slower touch-down than a wheel landing. It may be true that a wheel landing made at 60 m.p.h. would result in a shorter run-off than a stall landing at the same speed. But, given a plane that stalls down at 60, a wheel landing would have to be made at 65 or 70 m.p.h.—and a *longer* run-off would thus result.

No, the stall landing is *not* obsolete—nor is there any reason to believe that it is likely to become so. END

The Stall Landing is Obsolete

(*Continued from page* 31)

When a certain Army bomber was built, landing tests indicated that a maximum of 1.6-1.7 "G's" were placed on the landing gear. The gear was designed to withstand much heavier loads, but still the landing gear (and sometimes the tail section) failed because the huge force required to spin the gigantic wheels caused a rearward moment that not only injured the landing gear but snapped the tail like a whip.

The plane we have in mind for a lightplane pilot is a plane with small wheels that are easily brought up to speed. In a wheel landing, say at a speed 40 per cent above stalling, the rearward force is negligible. The difference in rubber and brake wear is not enough to bother about, especially when the other advantages of a wheel landing are noted.

THIRD. The most dangerous characteristic of an airplane is the stall—therefore, why stall? And yet it is recommended by some pilots that the plane be brought in "hanging on the prop" whenever the pilot wishes to make an accuracy landing. Most of the time a stall landing is not accurate, as many private pilots will testify as they sweat and practice to perform the difficult spot landing within 300 feet of a mark. A stall landing floats, or, if it does not float, the glide is often dangerously slow. On the other hand a wheel landing is accurate because the glide path and the rate of descent are controlled by the throttle, with the pilot literally aiming at the spot on the runway on which he is going to land.

The stall landing is a "special case" landing, to be used at sea in ditching, at land during emergencies, or landing on rough ground. Private pilots should know how to make this landing, but they also should know its shortcomings. More positively, they should know how easy, simple, and safe the wheel landing is.

FOURTH. We all know that the tail rises before take-off (in conventional gear planes), and that it stays up after a wheel landing, even after the speed is too low to permit the plane to become airborne again. During this time there is sufficient airspeed for positive rudder and elevator control.

Take the case of a plane striking the ground after a full stall landing. The pilot sits there, blind, dumb, and unhappy, ignorant of wind or gust conditions, just how the wing was stalled, not knowing if one wing is picking up lift or losing it. Many a good pilot has dragged a wing under such conditions.

Go back to the tail-high condition of the airplane before take-off and after a wheel landing. Recall that in this condition there was plenty of airspeed for full rudder control; also, that during a stall landing this condition exists for only a short time, so short in fact that many pilots ground-loop during this dangerous period. It would seem, therefore, that the slow speed during a stall landing is not an advantage as proponents argue: it is a disadvantage. Whether it is or whether it isn't, why do pilots who make wheel landings seldom ground loop? The reason must be this: the pilot

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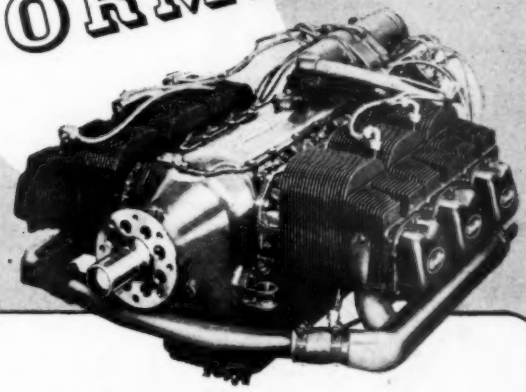

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has time to adjust his plane to wind and runway over a longer period, and by the time he slows down to a tail-down condition similar to the full-stall landing he is master of the situation.

FIFTH. As many beginners will testify, getting the stick back for a stall and knowing just how high the plane may be is very difficult. This difficulty persists all through flying, especially for those pilots who fly only on week-ends. Any miscalculation of speed that might lead to a high, rough landing is precisely what we wish to avoid. The average lightplane owner or operator cannot afford to repair his plane after very many "slight miscalculations" that merely result in rough landings.

Consider the easier wheel landing. We don't actually fly a plane straight on in at 200 f.p.m., although it can be done with a jar equal to a drop from two inches. What we actually do is flare the glide and ease the plane on; at this incidence there is still considerable lift remaining in the wing, making the plane lighter, and thereby easing the load on the landing gear.

SIXTH. Too much brake applied during taxiing or during the landing runoff has made more than a few instructors itch. The moment on the tail is light and a slight bit of brake will dip the nose. In the wheel landing there is a considerable moment on the tail, as explained in "argument four," above. This means that the brakes can be used during the runoff with less worry about nosing over because, if the nose dips, the pilot eases back on the stick. In one type of commercial airliner full brakes may be applied with impunity. Although the average lightplane owner isn't going to use his brakes in that manner, this point is useful information. (Note: great care must be used in experimenting with different types of plane.)

SEVENTH. In Captain Goodman's earnest and excellent discussion, issue was taken with the following statement: "Speed for speed, the wheel landing is shorter." Perhaps this needs clarification, because several pilots were in disagreement.

It is true that two planes that touch the runway at different speeds may require different lengths of runoff. Usually, the plane touching down at the higher speed will roll farther, because the energy varies as the square of the speed.

But "speed for speed" does not involve the speed of touching down. It relates to the glide speed, which should rightfully be included in any landing approach. Even (as Captain Goodman says) if a landing is a landing, depending upon which touches first, wheels or tail, the speed in the glide is the determining factor for this reason: Most commercial fields have an obstacle of some kind in the approach path, such as a transmission line, trees, hangars, etc. A plane coming in for a landing should have a safe gliding speed during this approach, preferably the maximum glide for private pilots, or the normal glide for more experienced flyers. Certainly we don't want "week-end" pilots dragging in on the propeller.

From the obstacle to the point where the plane actually comes to a stop is the critical distance, and this distance, speed for speed in the glide, is shorter for the plane that lands on its wheels simply because the latter airplane gets on the ground first and adds friction (brakes) to drag (flaps and wing). Proof of this statement may be found by viewing actual motion pictures of the two types of landing, made by one of the major airlines at Cheyenne, Wyo.

EIGHTH. How about the rusty pilot? Or the weak pilot? Or the long-interval flyer? Or the one who always levels off at 10 feet? Which landing would you, as a lightplane owner or operator, want these persons to make: the one in which a miscalculation is almost impossible, or the one in which an error means a wingtip, a landing gear, or a ground loop? It might be well to recall that in both the wheel and the stall landing it takes lots of throttle, aptitude, and technique to correct for an error, but that in the wheel landing there is less chance to make one.

In the final analysis it isn't so much that stall landings are bad, as it is that wheel landings offer more for your money. Why stall when wheel landings are easier? The stall, anywhere from 1,000 feet on down, is dangerous. This has been emphasized repeatedly by CAA reports. Ask any operator about wingtips, landing gear, ground loops, or stalls from higher than one foot. The answer is serious operational expense. Then ask him to compare that with results of wheel landings.

Try a few yourself. Then ask, "Which is easier . . . which is safer . . . which do my passengers prefer . . . which do I like better?" Experiment and trial is always better than argument because, as the old saying goes, "a man cannot be convinced against his will, because he is of the same opinion still."

There will always be a place and a time for a stall landing, such as emergency landings, but pilots who champion the old-style, full-stall are not convincing. For every reason in favor of the stall, there is a better one for the wheel landing. END

Planes Over the Counter

(*Continued from page 26*)

L. Bamberger and Co., Newark, N. J., *Ercoupes.*

Marshall Field & Co., Chicago, *Ercoupes.*

Mandel Brothers, Chicago, Piper *Cubs.*

Fair Store, Chicago, Taylorcrafts.

Some stores report comparatively few actual sales to date. However Marshall Field & Co. have orders "far surpassing highest expectations." Officials of other stores explain that lag in sales is probably due to the long wait for delivery which they expect to be remedied soon.

Factors which apparently discourage the customer who is aware of operational problems, according to store executives, are shortage of hangar space, the $15 to

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$20 a month rental charges for hangars, instruction costs after the free time offered by stores, actual scarcity of landing fields, and the known high costs of servicing planes. However, the uninitiated buyer doesn't meet these problems until the deal is closed and he talks to the airport operator face to face.

Although in many cases it is against store policy to reveal the financial agreement with the manufacturer or distributor, the average department store receives a commission ranging from 10 to 20 per cent of the amount of sale, depending on the arrangement.

Two plans for selling are in effect: the co-operative dealership plan and the full distributor plan. Under the co-operative dealership plan, stores receive a commission on planes sold through store contacts only. Salesman personnel in the store are generally experienced pilots placed there by the distributor. Stores supply radio and newspaper advertising in addition to a downtown showroom which the average distributor could not afford. The distributor, in turn, furnishes the credit and financing plan and makes arrangements for flight demonstrations and instruction with the local dealer.

Under the full distributorship plan, department stores supply their own salesman who arrange with local dealers for flight demonstrations, instruction, servicing and hangar service. Dealers and distributors resent this plan because it takes business away from their salesmen.

Irate airport operators complain bitterly of many unfavorable features of buying planes through department stores. They charge that, for one thing, the whole business of flight training is placed on a factory mass-production basis. Purchasers of store planes, they say, generally receive free lessons at a designated airport until they solo—provided solo doesn't take them much longer than the minimum of eight dual hours (five in the *Ercoupe*). Then, having completed its share of the agreement, the store turns the student loose with little or no future attention.

Yet that same student still needs the guidance of an instructor. He must have check rides and perfect his maneuvers. He may have difficulty finding a good instructor or he may have difficulty finding one who pleases him. Any instructor likes to follow through with the student until he gets his license, but this the store-furnished instructor cannot do. His job is to solo his student and then go on to the next one. This rush act, say operators, does not make safe flyers.

Another objection is that storage space is at a premium these days. The student pilot who buys a plane from the airport operator should be (though he may not always be) assured of storage space. Some of these disgruntled operators are considering putting the "no vacancy" sign to customers who buy store planes.

Others complain that the problems of flying are not sufficiently explained to would-be customers. Harry Wright, operator at Ashburn Airport, Chicago, cited the case of one proud new plane owner. He didn't realize when he signed on the dotted line that he had to take his instruction at an airport more than 30 miles from his home. He was completely ignorant of the fact that he had to have a license, pass an examination on Civil Air Regulations and couldn't fly passengers until he had a license. After he soloed he thought he was free to do as he chose. The store had neglected to inform him on these points.

When a prospective buyer is at an airport he sees all kinds of planes and has an opportunity to try them all out. At a store he finds one shiny new airplane in a setting blue with sales talk.

Operators naturally, feel that the best place to buy a plane is at an airport. As Charles Feris, Hinsdale, Ill., airport operator put it, "if you want a man's suit you don't go to a grocery store, you go to a men's clothing store, where you have selection and complete service."

An airport operator stresses the safety factor to all students. If he believes a student will not make a good safe pilot or will endanger lives he tells the student that flying just simply isn't for him. After such a person has bought a plane he's stuck with it.

W. R. Turgeon, operator of Chicago's Sky Harbor airport, believes there is a place for department stores in aviation—that of display and publicity, from which prospects can be obtained for the airports where plane demonstration and plane-owner service is to be provided.

Perhaps the biggest thorn in the operator's side is the commission angle.

As Fred L. Schumaker, operator of Chicago's Harlem airport, complained: "Airports were kept open during the war at a loss, and now that they have an opportunity to capitalize on the new market department stores are skimming the cream of their profits." Storage and repair work bring in negligible profits, he says, the most profitable part of the business being in sales commissions. He estimates that a small operator might have to sell gasoline for two years, or rent a plane for 400 hours, to equal the amount of commission received by department stores for selling one plane. This is creating much ill-will, he warns.

Airport operators stuck with the business during the hamburger stage, according to another operator, and now that they are about to sit down and enjoy steak for the first time, manufacturers are giving display planes to stores, while operators have to show their prospective customers pictures. Airports need business and must build traffic, and if the stores are taking away their commissions they feel reluctant to co-operate.

Manufacturers, distributors and dealers agree that store advertising and merchandising methods stimulate public interest in flying, that more people can inspect the planes in stores with more convenience than going to an airport, and that stores will undoubtedly find some plane purchasers who have never set foot on an airport. Manufacturers feel that stores are in a financial position to make cash deposits for planes ordered. But whether these favorable points will offset the negative attitudes of airport operators and dealers is a question yet to be decided. Generally speaking they are violently opposed to the idea. END

The Helicopter Today

(*Continued from page 45*)

change of lift. From the piloting standpoint this arrangement is not good enough.

The over-all pitch change of the rotor is a fair solution to the power lag problem. The pitch change response is much faster than the variation of power and good results can be obtained. But the pitch stick is an extra control which is one control too many. And, of course, the variations in power still must be made. This co-ordination of the throttle and pitch stick becomes difficult and adds to the great concentration already required of the pilot when flying in the slow flight range.

It seems that the only satisfactory solution to this problem will be to make the pitch change automatic. The principle can be borrowed from the constant speed propeller. A throttle movement will automatically induce the correct pitch change to absorb the change in power. The lag should be so small as to be unnoticeable.

In helicopter flight there is a considerable difference between the hovering regime and the regime of forward flight. This transition occurs at around 15 m.p.h. air speed. At this speed the doughnut air circulation breaks up and the rotor suddenly becomes much more efficient.

The most difficult flight condition for a helicopter pilot is hovering when a variable wind of about 15 m.p.h. is blowing. As the doughnut circulations break and re-establish themselves, wide and instantaneous adjustments of power must be made. A number of present day helicopters cannot be handled successfully under this flight condition because of their power lag. This flight condition is encountered fairly often.

Of course the real purpose of flight is to go some place. Also, hovering flight between about 10 and 200 to 300 feet will be dangerous due to the possibility of engine failure. The reason for this is that the helicopter discs are more heavily loaded than those of an autogiro. It is true that the windmilling rotors will set up a mild cushioning effect, but not enough to prevent injury to pilot or plane. If the altitude is above 300 feet, the pilot can make a less hazardous landing by gliding in as with an airplane of orthodox design.

But there still is a need for hovering flight in helicopters and without it the full potential use of this vehicle cannot be realized. Practically every landing and take-off will be made from or into the hovering flight regime. For this reason the control characteristics in hovering are very important.

A fully-castering undercarriage is a great aid to a pilot in landing a helicopter. It relieves him of the necessity of eliminating all lateral motion before contact with the ground is made. With it the hovering interval of time between transition and contact can be much shorter and if the aircraft does touch before the pilot is ready, the results are not so serious.

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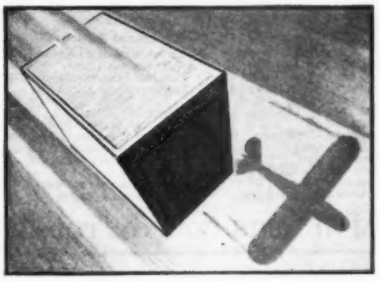

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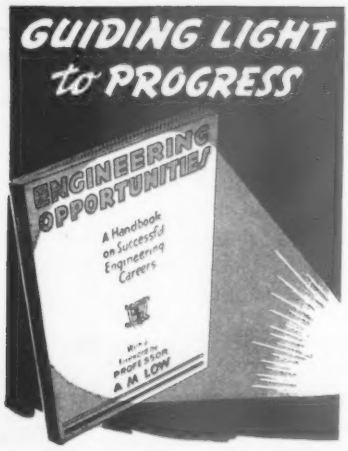

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present helicopters are not very good as measured by airplane standards. Fortunately these standards are higher than necessary and if the helicopter never attains them it won't make very much difference in its general acceptance.

Directional stability is good on most helicopters and is not hard to get. Most any amount of directional fin area can be used and that is all there is to solving this problem. Lateral stability is generally less in current models and is somewhat more complicated. But some can be had by placing the effective center of fin area above the center of gravity and, of course, some lateral stability can be obtained from the rotor itself. Naturally the two supplement each other and are sufficient.

The longitudinal stability in high-speed forward flight is least promising of the three. So far most helicopters have been very poor in this respect. A considerable amount of stability can be built into the rotor, but the fuselage itself is generally unstable. The usual horizontal tail surfaces cannot be used to stabilize it because of the rotor's downwash.

This was a problem in autogiro design, too, but the downwash condition there was not so severe and a horizontal surface could be located low and well forward where it would accomplish its purpose. This solution is not possible for a helicopter. Whether a very stable rotor is the answer or not, I do not know. Some very stable autogiro rotors have been built, in fact some were too stable for ordinary use. But a very stable rotor mounted on an unstable fuselage may give undesirable flight characteristics.

As mentioned earlier, all of the stabilities do not have to be perfect. A great deal of flying was done in unstable airplanes prior to 1930. Helicopters will be used generally for shorter flights where stability is not so important. Perfect stability is nice to have, but don't sell helicopters short because their stability at high speeds is not all we would like to have!

There is no doubt in my mind that the average citizen will be able to fly helicopters successfully—when he learns how. But it is going to take a lot of learning. And many a rotor is going to be broken while he is acquiring the ability to be completely aware of what is going on all around him. But when he learns something of the vagaries of winds and gusts and gets used to his complete freedom of movement, he will do all right.

A helicopter is subject to every gust of wind, or motion of the air. This is something that cannot be overlooked even with craft to be produced in future. The pilot must be schooled on the necessity of being alert at all times, particularly in landings and take-offs, against wind gusts. Until they are, we won't see helicopters—no matter how much they have been perfected—landing in congested, downtown districts. END

My Flying Began at 55

(*Continued from page 43*)

half at Tallahassee, Fla., and after filling the tanks, went on to Sarasota, where I landed at 7:10 p.m.

Of the 31 hours required to cover the 1,300 miles, my actual flying time was 10 hr. 55 min. My cash outlay was $24.78, which included 43½ gallons of fuel ($11.12), oil, including one change, ($2.66) and hotel room plus meals ($11).

While in Sarasota I received an urgent telephone call to come to New York. I wondered if my solo trip from Chicago to Sarasota had been haloed by phenomenal luck. I decided to trust in lightplane travel, so hopping in *Miss Bubbles* on April 9, at 11:55 a.m., I began my northward trek.

My flight itinerary showed a stop at Gainesville, Fla., for 45 minutes; Savannah, Ga., for 30 minutes, Charleston, S. C., for 14 hr. 5 min., including my overnight stop. Continuing the next day in weather that hovered between good to just fair, I stopped at Lumberton, N. C., for 30 minutes, Fayetteville for 1 hr. 40 min., Rocky Mount for 20 minutes; Richmond, Va., for 30 minutes and in Washington, D. C. for 23 hr. 35 min.

On April 10 at 7 p.m. I landed at Engineering Research Corporation's airport at Riverdale, Md., where the *Ercoupe* is manufactured. From there I continued on to Wilmington, Del., where I remained overnight, adding 17 hr. 50 min. to my time. As I progressed further north and east I began being somewhat apprehensive of the weather. My mind hurriedly reviewed Danny's advice when confronted with "frontal weather." However, the weather stayed contact so I flew from Wilmington's beautiful DuPont airport at 1:30 p.m. on April 12 and headed for New York City. Then, just as I was approaching Manhattan Island, the weather—for the first time—suddenly closed in on me. Since it obviously was "zero, zero" ahead, I turned left and followed the west bank of the Hudson River upstream where the weather looked somewhat more favorable.

At 2:40 p.m., unable to locate an airfield, I landed on a wet grass field near West Nyack, N. Y. Here I had my first accident. The field would have been long enough had the surface been dry, but when I applied the brakes *Miss Bubbles* skidded into a fence post at the field's far end, breaking the propeller. A telephone call to the New York office of the insurance company brought a new propeller within a short time. My take-off from the field was at 6:30 p.m. and my landing at La Guardia Field, which now had contact weather, was logged at 7 p.m.

A breakdown of the statistics of the trip showed that I had travelled approximately 1,400 miles, most of the time against headwinds as high as 25 m.p.h. My actual logged flying time was 15 hr. 25 min., and the total elapsed time from Sarasota to New York City, including the propeller incident delay, was 78 hr. 5 min.

Financially, I considered the trip quite successful. I spent $17.60 for 69 gallons of gasoline; 30 cents for one quart of oil; $10

for hotel rooms and taxicabs; $5 for meals and $1.20 for long distance calls. This totals $34.10 or an operating cost of not even 2½ cents per mile, excluding depreciation and insurance.

It was in preparing for the return New York-Chicago leg of this triangular cross-country jaunt that I recalled the advice of Danny Dudash about carefully charting my course and selecting reference points for check purposes. I was grateful for this training, for Pennsylvania has no section lines; roads wind through heavily-wooded mountains, and the terrain is anything but reassuring, at least to a cross-country novice like myself.

I took off from La Guardia Field on April 18 at 4:10 p.m., crossed the inspiring New York City skyline and headed for home. One hour later I landed at a neat, efficient airport in Coatesville, Pa. Spending the night in a hotel there, I continued toward Chicago the next morning, stopping at Harrisburg 20 minutes for fuel, then flying on to Lewiston, Pa., arriving there at 10:30 a.m. After filling the *Ercoupe's* tanks it was discovered that water had found its way into the airport's gasoline storage tanks and likewise had been pumped into the plane's fuel supply.

Thanks to the courteous and persistent efforts of the airport personnel all the fuel, including that in the gas line, was strained through chamois. This took several hours, but because of their efforts I now was confident that my engine wouldn't quit over the mountains ahead of me due to water in the fuel.

I took off against a strong headwind for Altoona, where I again refuelled, then flew on toward Greeneville, Pa. Climbing steadily to get over the mountain ranges before me, I was buffeted about by extremely strong gusts. I was trying to climb through the holes in the swiftly-moving cloud deck above and around me. My altitude was fluctuating constantly for one minute I would have to drop 500 feet to get beneath a swirling cloud and the next minute start climbing again to get over a mountain top. Directly ahead of me were thick, dark masses of clouds from which lightning could be seen darting from cloud to cloud, which indicated a series of thunderstorms.

All my studying of meteorology paid off then and there. I promptly landed in a farmer's field about 40 miles east of Greeneville, where I waited for the storm to pass. I phoned the Greeneville airport for weather information and despite a 30-m.p.h. surface wind, took off from the farmer's field and landed at Greeneville at 5 p.m.

The next morning the headwinds were still quite strong, but with full tanks and growing confidence in myself, I cleared to Cleveland's municipal airport, where I spent 35 minutes. Another 30 minutes was spent in Toledo and, leaving there, I headed for what appeared on my sectional chart to be a good airport at Goshen, Ind. Landing there at 12:05 p.m. I found the field to be a new one with no refueling facilities, so I flew over to Elkhart, filled the tanks and took-off at 12:35 p.m. for Chicago.

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check point, I cut off a small corner of Lake Michigan, followed the shoreline past Chicago's loop district, and then cut northwest toward Sky Harbor where I put the *Ercoupe* on the runway at exactly 2 p.m.

My flying time from La Guardia Field to Sky Harbor was 16½ hours—not airline schedule, but assuredly not the forever-and-a-day predicted by the pessimists. On this final leg of the trip I spent a total of $31.80, which included 74 gallons of gasoline, two quarts of oil, 60 cents for long distance calls, $7 for hotel rooms and transportation and $5.10 for meals.

Recomputing the entire trip, an approximate total of 3,600 miles—which, bear in mind, was the *first* solo cross-country trip of a 55-year old private pilot—I logged a total flying time of 42 hr. 50 min., with a total elapsed time of 5 days, 13 hr. 20 min. My total expenses were $90.68, which upheld the average travel cost of 2½ cents per mile. I have deducted 24 hours of elapsed time which I spent at the *Ercoupe* plant with Julian Zenitz, pilot and engineer, dreaming up different places to go, new things to see and getting to all of them in one of the new lightplanes that will be available to everyone in the very near future.

From my experience other men my age, or even older, may be encouraged to participate actively in the air age. My cross-country trip proved to me that lightplane travel is rapid, comfortable, economical and enjoyable. It also proved to me that flying is not essentially a young man's game—it is the fulfillment of a hobby, recreation, travel and participation in progress all in one. And it conclusively indicated to me the feasibility of getting in one's own little lightplane and going places. END

Civilian Jobs for Airmen

(*Continued from page 24*)

provide on-the-job training for a maximum of one year.

Under the Apprentice Training Service, which has been in operation since 1937 and now is under the newly reorganized United States Department of Labor, the discharged serviceman can learn a vocation in any state-approved setup. Again he receives a wage from the employers and the G.I. Bill of Rights living allowance, provided the total does not exceed the regular journeyman rate for the occupation. In the latter event the Government allowance is reduced. Four years is the maximum period for apprentice training.

From its Washington headquarters, the Apprentice Training Service has dispatched material to educational and training offices of the armed forces both overseas and in the United States. It recommends one of three steps to the veteran interested in apprentice training after his discharge: (1) that he contact an employer in the trade of his choice, or (2) the labor union in the trade, or (3) a United States Employment Service office.

The USES, which has some 1,500 full-time local offices scattered throughout the United States, operates a counseling service of its own and has up-to-the-minute data on job opportunities and trends of employment. It is the USES counselor's job to interview the veteran, learn his military and previous peacetime experience, education and the field in which he is interested. Then the USES is equipped to advise him on employment opportunities available and on any further vocational training he may need.

Maj. C. C. Moseley, president of Cal-Aero Technical Institute, states that the Aeronautical Training Society draws two conclusions from a recent nationwide survey: (1) The end of the war will witness the greatest back-to-school movement in history, with a majority of the 12,000,000 service men and women wanting more education or retraining; (2) more of our fighting men aspire to careers in aviation than in any industry or occupation.

In order to enroll in a school, the returning veteran needs only a "letter of eligibility" for training which he obtains from the nearest Veterans' Bureau. He then may select, of his own free will, any school he wishes to attend. He need only ascertain that it is approved by the Veterans Administration, present his letter of eligibility and enroll. He's strictly on his own, with the Veterans Administration making sure that no one takes advantage of him, Major Moseley points out.

For the returning airman who seeks pilot training and wants to enroll in one of the nation's numerous flight schools, there is a slight "hitch" in the $500 payment which the Government makes for any ordinary school year. Such a school year is defined as 30 to 38 weeks and flight training courses run much less than that figure. Hence, the Veterans Administration can pay only a proportionate weekly sum toward a pilot training course. Five hundred dollars, figured on a basis of 30 weeks ordinary schooling, would average only $16.67 a week. The discharged veteran enrolled in a flight school of 15 weeks duration thus would only receive $16.67 a week or $250.05. Legislation now is pending, however, to amend the G.I. Bill of Rights to enable the Government to pay a larger amount for short-term, intensive training as in flight schools, photographic schools or post-graduate courses.

CAA's survey of returnees at an AAF eastern personnel distribution center showed that, among the group polled, no enlisted man favored remaining in the AAF after the war as an enlisted man and only one per cent expressed a desire to be a regular Army flyer. However, the Air Technical Service Command—the maintenance outfit of the AAF and a service that will continue post-war—has several thousand civilian jobs under its wing. The jobs are filled primarily by veterans with the emphasis on disabled personnel. Mid-September statistics revealed that ATSC had placed approximately 22,000 persons—primarily AAF personnel—which represents about 12 per

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cent of the civilian jobs under its command.

The CAA poll also disclosed that 16 per cent of the enlisted AAF personnel want to get jobs in aircraft factories or as airline mechanics. Twelve per cent of the officers want to work for themselves in aviation, operating schools or airlines, and 17 per cent would like jobs as pilots on domestic or foreign airlines. Very few—about one per cent—of either officers or enlisted men who want flying careers, look favorably on the flight instructor's job.

Three-fourths of the officers interviewed by CAA who plan to seek aviation employment were pilots. More than half the enlisted men similarly interested have been gunners while another fourth have been mechanics or technicians. Among both officers and enlisted men their pre-war occupations generally were similar to their choice for post-war.

A wide range of skills exists in the occupations of the air transportation industry engaged in the transportation of passengers, mail and freight. A relatively high proportion are professional and technical personnel, although the absolute numbers are small. The largest of these groups consists of pilots and other flight officers; the next largest includes engineers (chiefly aeronautical, mechanical and radio), and managers (business and personnel). Small numbers of accountants, meteorologists, doctors, nurses, lawyers, economists and statisticians also are employed.

The occupational range of ground personnel, who comprise the bulk of the industry, includes airplane, engine, and instrument mechanics, repair machinists and machine tool operators, air field and hangar maintenance men, upholsterers, cleaners, greasers, and laborers, and such white-collar jobs as bookkeepers, record clerks, and ticket sellers.

All airport shopwork is under the direct supervision of aircraft or aircraft engine mechanics certified by the Civil Aeronautics Board. To obtain such a certificate an applicant must have a year's experience in related work and must pass an examination conducted by the board.

Salaries in the top administrative jobs—such as operations managers, supervisors, and superintendents—range from $3,600 to $10,200 per year. Earnings for pilots average about $600 a month. Wage rates for skilled mechanics and aircraft repair men ranged between 90 cents and $1.10 an hour in peacetime but currently are about 20 per cent higher. Unskilled ground personnel are paid less than for similar jobs in other industries, entry wages averaging around 60 cents an hour.

In the post-war period there also may well develop a secondary industry in servicing and maintaining facilities for private plane operators. Although the growth of plane-servicing opportunities probably will not match the development of automobile garage and service facilities which followed the last war, it should provide several thousand jobs in smaller air fields catering to private plane operators who will require storage, repair, fuel and other services. END

Report from Washington

(*Continued from page 75*)

ium, a navigator who knows LORAN alone, celestial navigation alone or radio navigation alone is not a well-rounded navigator. He must have a working knowledge of all navigational systems, because each one can fail under certain circumstances.

The institute, organized in Washington in February, 1945, proposes to establish:

1. A journal containing articles on navigation as a science and on instruments and methods.
2. A research center for advanced study, compilation of information, evaluation of new methods and instruments and aid in placing competent navigators.
3. Grants and fellowships.
4. Co-ordination of university, Army, Navy and industrial education to encourage uniformity in terminology and computational practices.
5. Committes on professional standards to influence Government licensing and to insure safety in the air and on the sea. Colin H. McIntosh of American Airlines is president.

Airplanes

Although Curtiss-Wright and Eastern Air Lines mutually agreed to cancel Eastern's order for 10 *Commandos* (CW-20E) and there are now no outstanding contracts for the big, twin-engined plane in the United States, the CAA certification tests will continue. Under an arrangement worked out by CAA, RFC and Curtiss, the *Commando* will be run through its certification tests at Buffalo airport rather than at one of the CAA test centers.

Fairchild is planning to increase the power of the *Packet* (C-82) by about 50 per cent and to make a few aerodynamic changes in the twin-engined plane, as a means of increasing the cruising speed to approximately 250 m.p.h. It now cruises at 200 m.p.h.

Oldest Navy Squadron

The Navy's oldest aviation squadron, Utility Squadron 1 completed its 20th year of service to the Pacific fleet in October. Commissioned at San Diego in 1925, the squadron's first major project was the first Alaskan aerial survey expedition in 1926. High spot of drama and excitement for the squadron came at Pearl Harbor on December 7, 1941. Within a few minutes after the first alarm its crews had mounted machine guns in the cockpits of their little amphibious planes and were bravely taking off after the enemy. The Japanese had scorned to bomb or strafe the green and orange utility planes and had left them unharmed. For heroic acts during that attack on Pearl Harbor many men of the squadron received the Navy Cross or commendations. The squadron is now based at Moffett Field, Calif., with Lieut Comdr. Joseph Garrett as commanding officer.

People

Clarence F. Cornish, lieutenant colonel of Air Forces who served on the Interdepartmental Air Traffic Control Board during the war, has left the Army to become director of the Indiana state aviation commission. Cornish was manager of the Fort Wayne, Ind., airport before the war . . . Lloyd Child, test pilot for Curtiss-Wright for many years, has been appointed secretary of the Non-scheduled Flying Advisory Committee to succeed Jack Nelson, resigned END

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"And naturally, the best place to prepare for all this is Roosevelt—where you're studying now?" Jim teased.

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Jim frowned. "But what if I'm drafted?"

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Frank J. Gay, Jr.,
AOPA Pilot 13211

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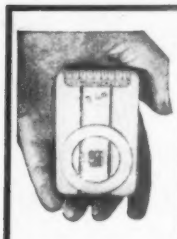

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Planes of the German Air Force

(*Continued from page 76*)

confused maze, are highly vulnerable to damage, and take much longer to repair than do comparable American systems.

One of the greatest single mistakes the Germans made with their air force was to discontinue the design, development and use of heavy bombers. They tried a sort of last-minute comeback with the Heinkel He-177 but even the Germans themselves admitted that that design was a miserable failure. The great majority of German aircraft production was of fighters—and those were good. But the Germans had automatically placed themselves on the defensive by dropping their bomber program.

What with the terrific fuel shortage and overwhelming Allied air superiority, the German air force ended the war sitting on the ground. Even at this moment there are thousands of the *Luftwaffe's* first-line planes sitting around on the ground all over Germany. Even the jet fighters—of which the Germans had thousands, both completed and in production—were grounded for lack of fuel. This despite the fact that one important reason for the high-priority development of the jet airplane was that it could burn almost any type of fuel, down to and including fuel oil.

Standardization on the two German fighter types (Me-109 and Fw-190) was an advantage to the Germans from a viewpoint of production and maintenance but it meant ceaseless improvement to offset the new Allied types that constantly appeared. This is particulary well-illustrated in the case of the Me-109, which in 1937 had a 500-h.p. engine and in its modern Me-109K version had nearly 2,000 h.p., was about as fast as the *Mustang* and had 10 times the firepower of the original Me-109. Nonetheless, the increased firepower demanded to counteract the American daylight heavy bomber offensive resulted in a very heavy load for a small fighter and detracted appreciably from its potential performance if it had been designed from the ground up to meet the new conditions. Messerschmitt did attempt to build better fighters, of course—the Me-209 and Me-309—but neither of these was enough to warrant re-tooling for production. Neither of these planes (the Me-309 had a tricycle landing gear) ever became operational.

Similarly, the Fw-190 was an excellent fighter though in the earlier years its BMW-801 engine gave very poor altitude performance. Eventually it was completely redesigned as the Ta-152, which was virtually a new type. The Ta-152 had an excellent performance, particularly the "H" version. It had an amazingly long wing and with the *Jumo-213* engine it had a top speed of over 460 m.p.h. at 41,000 feet. Kurt Tank, the designer, tells how, when testing a Ta-152H a few weeks before the collapse, he outstripped a flight of pursuing *Mustangs*.

A remarkable high altitude fighter under development was the Bv-155 with a liquid-cooled DB-603, which was expected to attain its top speed of nearly 430 m.p.h. at over 50,000 feet—far higher than the known ceiling of Allied fighters.

It should be noted, too, that the first jet-propelled airplane to fly anywhere in the world was the Heinkel He-178 on August 27, 1939—four days before the Germans marched into Poland. Though experimental, it provided useful data for subsequent successful German jet jobs.

The standard Me-262A fighter which was in service at the time the war ended had a top speed of 525 m.p.h. at 23,000 feet and a service ceiling just under 40,000 feet. Handling qualities were good and landing speed was not too high—about 120 m.p.h. Towards the end of the war, the Germans emphasized rapid climb, and highly specialized rocket interceptors with extremely short duration were under development.

One such plane in service for several months before the collapse was the Me-163 *Komet*, a semi-tailless design capable of level flight speed of about 550 m.p.h. and able to climb to 30,000 feet in just over 2½ minutes. It was armed with two 30-mm. cannon. A later model, the Me-163C had a special rocket unit incorporating a second jet to give cruising economy.

Endurance of the Me-163C was only about 12 minutes and the maximum speed 590 m.p.h. The British are inclined to discount much of the effectiveness of these planes because of their limited endurance, but many American experts feel that in greater numbers they could have wrought enormous havoc in intercepting American daylight bomber formations. Meanwhile, the Germans were developing a last ditch airplane—the BP-20 or *Natter* ("*Viper*"), a liquid-rocket powered craft with only an 18-foot wing span, capable of vertical take-off and the ability to climb at the rate of about 37,000 feet per minute. It was designed to attack bombers with a battery of rocket projectiles. Upon firing these projectiles, the pilot was to be ejected and descend by parachute, while simultaneously the rear half of the fuselage containing the liquid rocket would break off and itself descend by parachute.

In twin-engined fighters, the Me-110 and Do-217 night fighters are not considered to have been so effective as the Ju-88. Towards the end of the war, the Ju-88G night fighter had efficient radar equipment, a five-hour endurance, good handling qualities, a compact battery of four 20-mm. cannon firing forward and two 20-mm. cannon firing obliquely upwards. Further, it had a reasonable speed margin over the British night bombers. The Ju-388 was about to be issued as the war ended and had a performance approaching that of the *Mosquito*.

At the beginning of the war, the standard German bombers were the He-111, Do-17 and Ju-88. The Do-17 soon disappeared from service but the He-111 and Ju-88 remained to the end. Their bomb loads were quite small but improved. The He-177, of course, was a dismal failure because of fire hazards, structural failures and inferior performance. Development

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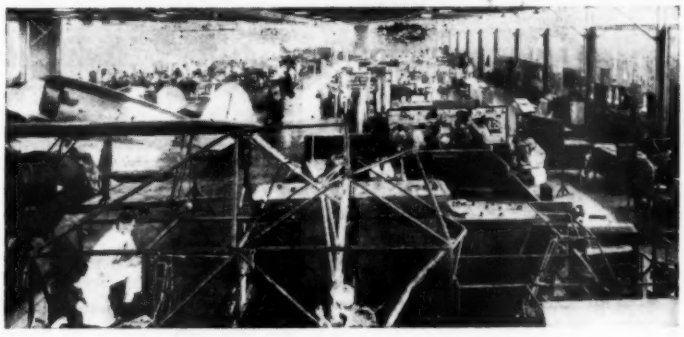

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was not continued. The Germans also tried other heavy bombers—the four-engined Ju-290 and the six-engined Ju-390 which was originally produced as a transport. Farman was working on the He-274 in France; Messerschmitt on the Me-264 which was designed to bomb New York, and Focke-Wulf on the six-engined Ta-400.

Jet-propelled bombers also were attractive to the Germans. The Arado Ar-234B could carry up to 4,000 pounds of bombs and had a top speed of 470 m.p.h., and the Ar-234C with four BMW-003 jets had a speed of over 540 m.p.h. Meanwhile Junkers had already flown the Ju-287 with six BMW-003 jet units. It had a sharply swept-forward wing giving it the appearance of a tail-first aircraft and had a maximum designed bomb load of 10,000 pounds and a range of 1,175 miles with a bomb load of 6,600 pounds, with a maximum speed of over 530 m.p.h.

For reconnaissance, the Germans used adaptations of their standard fighters and bombers, including jet-propelled types, but they were working on a specialized reconnaissance craft, the 8-635, which was a "Siamese-twin" combination of two Do-335's with a range of over 4,000 miles.

Arado, according to the British, had the most imaginative design of a transport aircraft, the Ar-232. This strange creation could have two or four engines and was fitted with an undercarriage like a centipede. It was designed to kneel like a camel or elephant for easy loading.

From the foregoing, it is plain that German aircraft development continued actively even in the last days of the war. Many other new types have not been mentioned in this brief summary but may be found in the accompanying tables.

In all this there was much that was revolutionary in design. Full comparisons with U.S. and British accomplishments and experiments are not yet possible, but tentative conclusions can be drawn.

First, one of the main difficulties confronting the Germans was lack of endurance. The British Air Ministry regards some of the performance figures as "staggering" but concludes that "in actual fact they could be maintained for such a small space of time as to make them doubtful quantities in operation." It is not certain that the American view would agree with this conclusion.

Second, it appears that the German aircraft and aircraft engine designers suffered from a lack of co-ordination and direction from above. They appeared to be in frantic competition with each other to produce a weapon which would overcome Allied superiority and turn the air war in their favor.

Third, as a consequence, many prototypes were produced only to be scrapped in favor of a design which seemed to offer greater possibilities. As a result of this policy, the *Luftwaffe* always suffered from a shortage of orthodox aircraft able to challenge the air superiority which the Allies built up. END

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London Letter

(*Continued from page* 50)

ternationale met in Paris for the first time since the war the methods of checking world records were discussed and especially the methods of timing the world speed record. But the system of timing used in the British attempt and also the general pattern of the rules were the same as they used to be.

The 9,842.4-foot speed course, with "run-ins" of 1,740 feet, was again used and the maximum height allowed was again 246 feet in the course and "run-in" and 1,310 feet at any time during the entire flight.

Little was said about the Rolls-Royce *Derwent* jet units which were employed for the attempt, for most of the descriptions referred to the *Derwent Mark I*, an earlier Mark of engine. The *Derwent* in the *Meteor* that was prepared for the record attack, is a very different engine and gives a much increased static thrust.

Rineanna

The controversy about airports continues. Eire holds a key position with her new airport on the Shannon at Rineanna and this airport, which will be open to American lines according to the agreement recently entered into, cuts away any bargaining power Britain might formerly have possessed.

Meanwhile the position of London without proper airport facilities excites repeated criticism in Parliament. Heath Row is going to take a long time to complete though it will be ready for limited commercial operation by summer. END

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I Learned About . . .

(*Continued from page 81*)

directly into the sun. As far as I could see there was nothing but endless miles of tumbling cotton. I leveled off about 300 feet above the overcast and turned my tail to the sun. Gradually my compass became normal. I took a heading of 270° and checked my watch. I'd been out from Albany an hour and 20 minutes. It seemed like an eternity.

Ten minutes more and a break in the overcast appeared directly ahead. I didn't know where I was nor what the winds were aloft. If I continued on top I might be south of clear weather at Syracuse, or I might be north of it and wind up over Lake Ontario. I decided to go down if the opening was clear when I got up to it. It was, so I scooted earthward.

The ceiling was still low but it was gorgeous weather to me in comparison with what I'd been through. I spotted a north-south railroad and headed north right on top of it. Then abruptly I came to the barge canal and breathed a sigh of relief.

Three hours and 20 minutes after my departure from Albany, I touched my wheels down on the Rochester Municipal Airport. Max Dutcher, the assistant airport manager, flagged me over to the west hangar. I pulled up, cut the engine and just sat there.

Slowly I swung out of the plane and walked to my car. I started the motor, backed around and headed for town.

Even if my car had been a broken-down model T, the whir of its tires on the concrete pavement would still have been music in my ears. END

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STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933

Of Flying, Published Monthly at Chicago, Ill., for Oct. 1, 1945.

State of Illinois, } ss.
County of Cook }

Before me, a notary public in and for the State and county aforesaid, personally appeared A. T. Pullen, who, having been duly sworn according to law, deposes and says that he is the Business Manager of Flying and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, W. B. Ziff, 185 N. Wabash Ave., Chicago 1, Ill.; Editor, W. B. Ziff, 185 N. Wabash Ave., Chicago 1, Ill.; Managing Editor, Max Karant, 185 N. Wabash Ave., Chicago 1, Ill.; Business Manager, A. T. Pullen, 185 N. Wabash Ave., Chicago 1, Ill.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its names and address, as well as those of each individual member, must be given.)

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3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is ..... (This information is required from daily publications only.)

ARTHUR T. PULLEN,
Business Manager.

Sworn to and subscribed before me this 28th day of September, 1945.

[SEAL.] A. C. JEPPE,
Notary Public.

(My commission expires March 16, 1949.)